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VOL LVI 18 JANUARY 1947 No 1438

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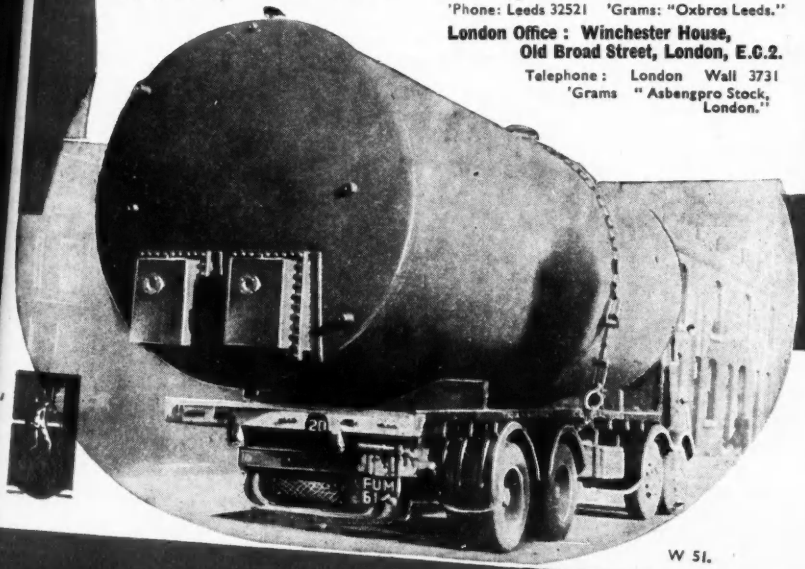

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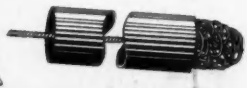

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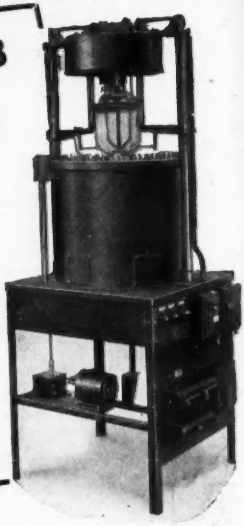

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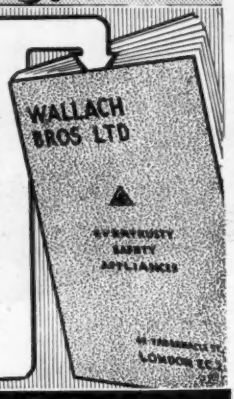

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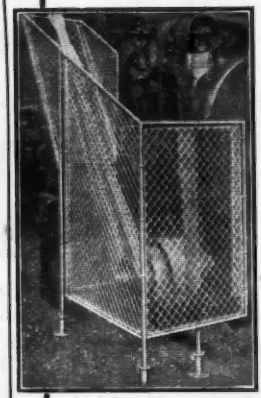

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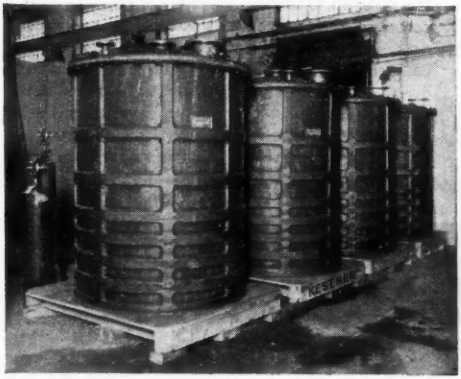

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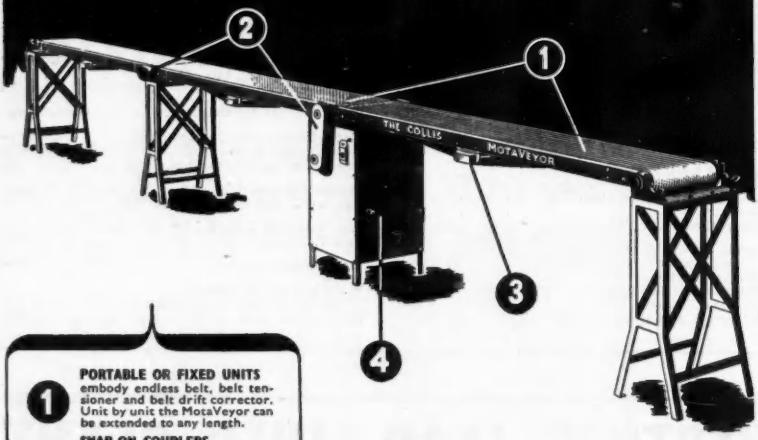

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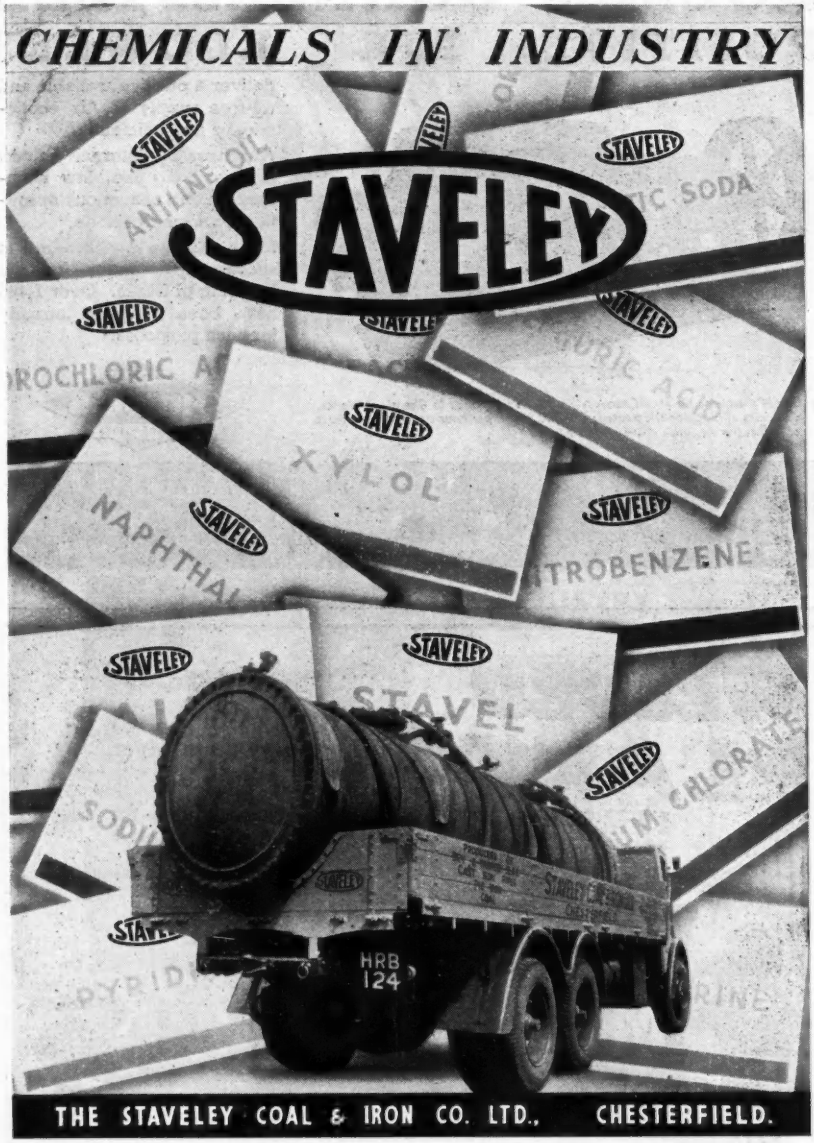
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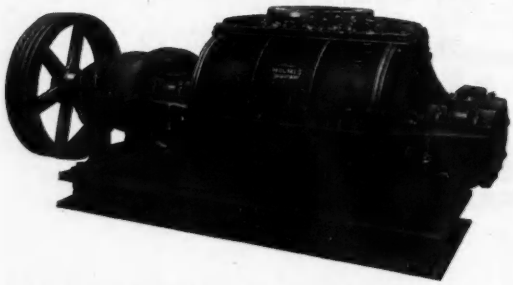

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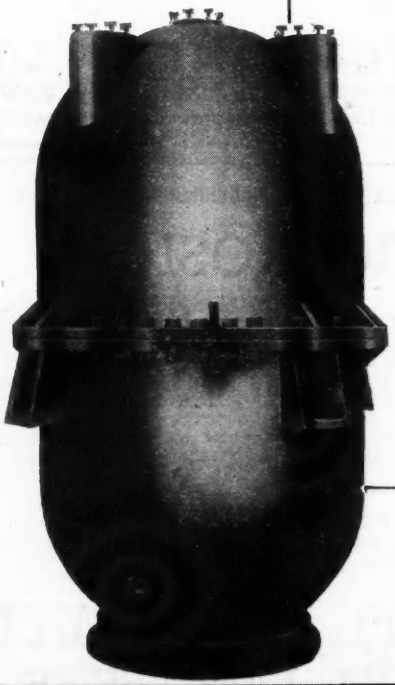

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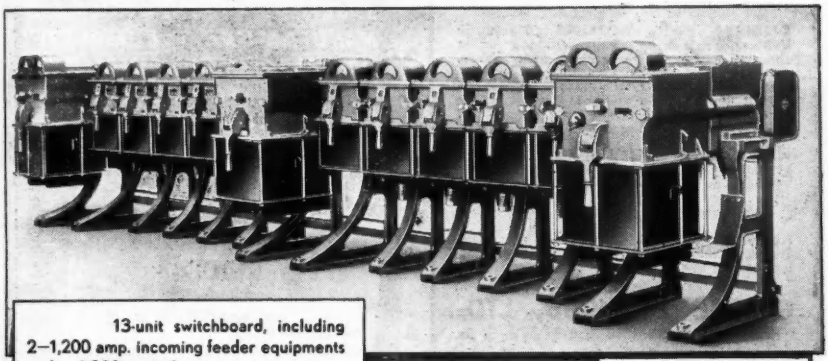

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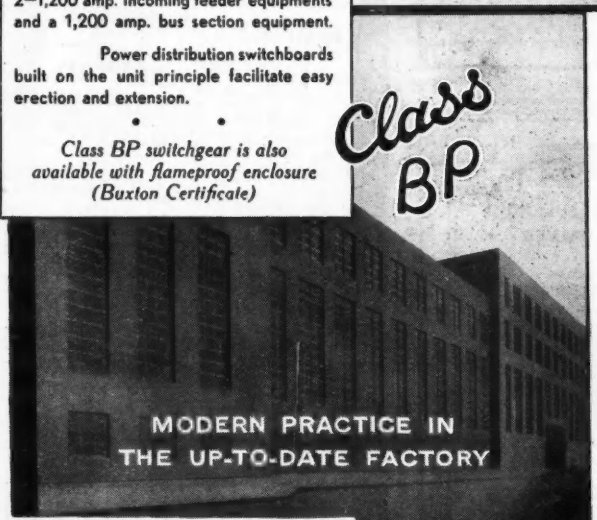

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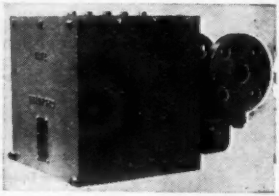

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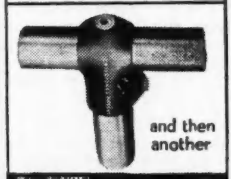

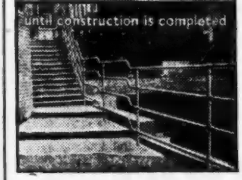

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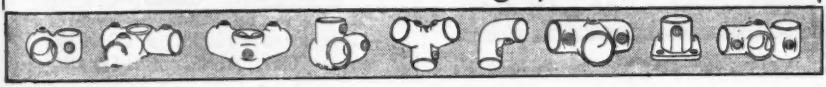

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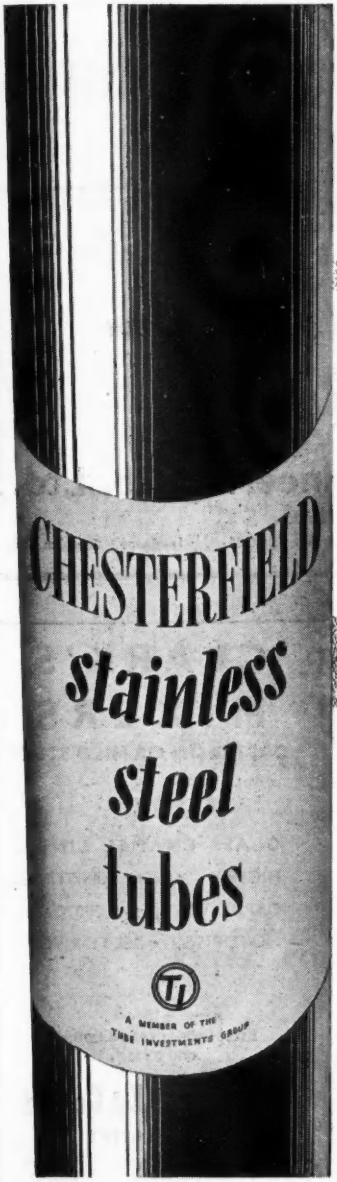

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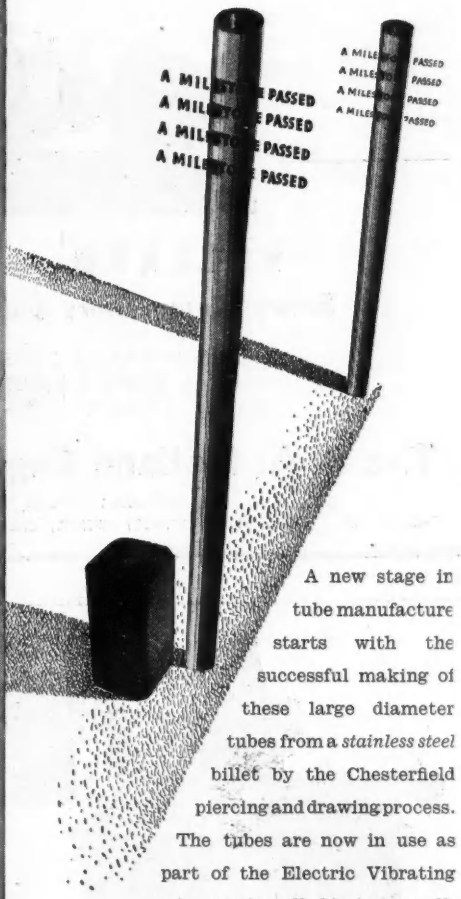

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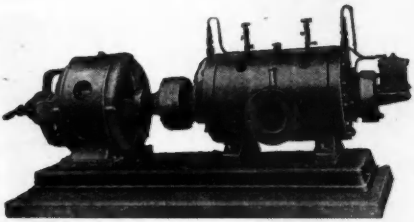

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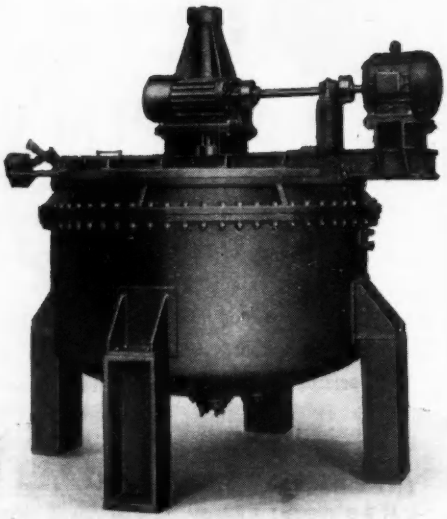

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The Reports on German Industry

NEVER within historical records has the industry and technical knowledge of a defeated nation been subjected to so detailed and exhaustive an examination as that of Germany following the conclusion of the late war. This much is clear from the analysis of the exhibition staged by the Board of Trade which was reported in our issue of December 14. In past wars, fought in the now dim light of the dawn of history, the victors were wont to make slaves of the defeated, and in this way not only did the victors learn the secrets of their arts but caused them to apply those arts for the benefit of the victors to the end of their days. This is now called "reparations."

The duration of the period during which the vanquished work for the victors is limited by the sum which the vanquished has to earn before his war indemnity is discharged. The effect, in the modern world, seems to be that the victors suffer from this practice more than the vanquished. It certainly seems to confer little benefit on anyone. Nevertheless, the old practice was a means of solving manpower problems, and when these are acute, as they are today, even modern governments seem disposed to return to it by holding a proportion of their prisoners of war captive until certain urgent work of restoration has been completed by them. All of which seems to some moderns, ourselves included, to be highly confusing.

There is, however, another form of "reparation" which it is open to the victors to exercise without any great detriment to themselves or, in point of fact, to the conquered. That method is to discover how to make use of whatever skill and experience the defeated nation may possess, in the interest of everyone. In many wars that principle has not arisen. It would not be likely, for example, that the industries and arts of Abyssinia could teach much to those of Italy when Italy had been victorious in the days of Mussolini.

Germany, however, was an entirely different case. The wealth, technical skill, scientific reputation, and industrial "know-how" of Germany have been an international theme of the highest consequence for a hundred years, growing greater each year and ultimately—when used for bad ends—casting a shadow over the whole earth. It was just that the rest of the world should learn whatever was to be learned about the way in which this was done. When skill is used for evil ends, it is right that it should be canalised for beneficent purposes. If the original possessors of

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that knowledge cannot be trusted to use their skill in that way, then the rest of the world should be told how to do so.

Accordingly, urged by the great reputaton of German industry for thoroughness and enterprise, the Allied nations prepared for teams of industrial and scientific investigators to follow hard on the heels of the advancing armies to make reports about what they found there and to discover the innermost secrets of German industry. These investigations are not yet complete and even now a few teams go out from time to time and come back with more information. The task is virtually at an end, however, and the peak of this effort has long since passed. So thorough has been the investigation that it is becoming almost rare to encounter a technical man of standing who has not been a member of the teams. In all, 2905 teams, comprising 10,768 investigators, have searched through the German industrial works, laboratories and drawing offices. They have issued 10,608 preliminary reports and in addition have sent home 2240 consignments of documents, each containing between 1 and 1000 individual papers and 1073 samples which have been subjected to analysis and testing. The whole matter has been summarised in a printed list of documents entitled "Technical Index of Reports on German Industry" (H.M. Stationery Office, 5s.), which is complete up to July 27 last, and a further "revised and consolidated" list entitled "Classified list No. 2 of Industrialists Reports on Germany," (H.M. Stationery Office, 6d.). These documents, though nothing more than lists of reports, indicate the amazing volume of information that has come out of Germany as the result of the labours of these teams. The reports are on sale for each and every individual in this country, *and in the rest of the world*, to read **and use.**

The caveat must be entered that such of the information as is covered already by British patents cannot be used here with impunity. It is known that a great many British firms entered into arrangements with German firms before the war whereby the British firms had the advantage of some of the information now made public. There were cases, of course, in which the British patents could not be operated because of prohibitive arrangements, and in such cases care must now be taken that the information is applied in this country, if it has a commercial application. The information contained in the classified lists will enable each industry and each firm to pick out the reports that particularly interest it for study. This opporunity will never recur. Here is a mass of information that may be put to good use. In a little while other countries will so have used it that its value to us will be reduced materially. This is the time when whatever is good should be assimilated into British industry.

It may well be asked, however, what of real value has been achieved by these teams of investigators. That is a question upon which there will be mixed views. There are no doubt some reports that contain things completely new to this country, matters upon which our manufacturers have been awaiting information rather anxiously and for lack of which they have been handicapped in world competition. But it must be confessed that by and large the technical investigation of German industry as evidenced by the reports has proved disappointing. In many fields, to our surprise, the Germans have been shown to be behind us. That cannot be ascribed altogether to any success the Germans have had in misleading our investigators: the evidence of the works themselves bears eloquent testimony that whatever pre-eminence the Germans possessed in the field of international industry was not apparently due to their superior technical skill or to the superior ability of their research workers.

To what then was it due? That is a question that we should like to see debated. We may have our own views, but it is not for us to express them. It is for the members of the investigating teams who have learned the innermost secrets of the organisation of German industry and its relationship with successive German governments to tell us by what strange and underground methods the German industrial machine gained its international power and reputation. No doubt the handicaps placed by the Nazis upon the development of German civil industry did much to cause the conditions our teams now find. We are gravely concerned lest the present handicaps due to nationalisation may place the same restrictive hand upon our own enterprise. But was the Germany of 1930 any better qualified technically than the Germany of 1939-45?

NOTES AND COMMENTS

PROPOSED INTERNATIONAL EXHIBITION

THE World's First International Exhibition which in 1851 turned Hyde Park into a Mecca of all nations was, we suppose, one of the " high-lights " of the Victorian age. Certainly it must have been among the minor glories of that glorious era. So perhaps there is something sentimental in our hope, which we share with many others, that it will after all be found practicable to stage the International Exhibition of our own generation in Hyde Park and in 1951—the centenary year. Perhaps we see in it a happy omen, signalising Britain's re-capture of some of that greatness which seemed to die with the great Queen. Elsewhere in this issue we announce a conference arranged by the Royal Society of Arts to further the promotion of another such exhibition, the principle of which has already been approved by the Government. At the moment, however, it seems the Government has doubts about its practicability, believing that public opinion would be against the use of Hyde Park as a site for the exhibition; that any other site of adequate size could be found only outside London; and that this or any other large-scale exhibition would demand labour and materials which, in view of other claims, could not be met so early as 1951. The Royal Society of Arts, in a memorandum being circulated with invitations to the conference, counters the Government attitude with sound arguments which, we hope, will cause second thoughts to prevail in Whitehall. The Society believes that Londoners would accept the temporary loss of Hyde Park in good spirit if they realised what potential value the exhibition might have not only for London but for the whole country and indeed the British Commonwealth. Any permanent spoliation, such as the felling or transplanting of trees, obviously would have to be avoided. Otherwise, objections to the conversion of Hyde Park into an exhibition ground are only echoing those raised prior to the 1851 project and which were subsequently found to have been unjustified. After all, there are other London parks in which to exercise one's dog or feed the birds or otherwise disport oneself according to taste. As to the Government doubts concerning the drain on labour and materials, the Royal Society contends that by 1951 the present housing problem will be largely solved; that in any case new materials, including the light alloys, are coming into use and might be used in place of timber; and, that, if necessary, foreign exhibitors might be asked to provide materials for their own pavilions.

ECONOMIC VALUE

THE Royal Society's most compelling argument, however, is that of the " immense economic advantage " which the country would derive from the proposed exhibition. " It can be confidently expected to give a great stimulus to all branches of British trade, at home and abroad," stated the memorandum. " In particular, it cannot fail greatly to encourage the tourist industry, now just beginning to develop, bringing in the future a direct increase in national employment and income, and indirectly an importation of foreign money, which may perhaps go far to recoup the loss of foreign exchange through the war-time sacrifice of British investments abroad. But more important in the long run than any material considerations on the one side or on the other, is the value of such an exhibition in helping to raise the morale of the nation and its international prestige. As a consequence of the two wars, and of certain intellectual tendencies of our time, a spirit of pessimism is evident, in this as in other countries. Some striking manifestation is greatly needed of the positive achievements of modern civilisation—not only in the domain of physical science and industrial development, but also in all cultural activities and in its spiritual aspects."

WAGE RATES IN LONDON

AN example of the complexity of the prevailing system for regulating wages and conditions and of the liability of the elaborate negotiating machinery completely to miss its target is reflected in the recent unrest reported in one or two sections of the fine chemicals industry in London. This friction, ironically enough, was the direct outcome of the operation of an agreement freely negotiated at the request of the workers' re-

presentatives by the authoritative wage regulating body (the Drug and Fine Chemicals Trade Joint Committee) with the object of enhancing wage rates in the London area. Whether or not the cost of living in London is sufficiently higher than that of the provincial centres of the chemical industry to justify such discrimination is open to question, and the apparent privilege conferred on the London workers is in any case not calculated to have a steadying effect on labour conditions elsewhere. These, however, are secondary considerations by comparison with the immediate effect of the agreement which has been, in some factories at least, to unsettle workers who in the past had been granted weekly wage rates higher—in some cases, it is stated, ten shillings higher—than the newly raised official minimum. Such workers have, understandably, gained nothing by the present " victory " for group bargaining and were sufficiently incensed by finding that the first pay envelope of 1947 contained at the best no more and at the worst, less, than in 1946, to discuss the advisability of staging a sit-down strike. That the effect of the agreement has been to scale up the less fortunate categories of chemical employees seems to have given little satisfaction to those who, in effect, had already had their cake, and the outcome has been to sow dissatisfaction where none was evident before.

COAL RATIONING

IN a period in which all news about the vital topic of coal supplies seems habitually to be bad news the announcements made this week by the President of the Board of Trade (Sir Stafford Cripps) with the backing of the Fuel Minister (Mr. E. Shinwell) seem by comparison with some recent Government pronouncements to contain more than a grain of hope. The fact that coal supplies are quite inadequate even for the present small-scale " prosperity drive " and cannot quickly be augmented from home resources or from overseas has been evidenced repeatedly since the relaxation of war security measures permitted such information to be published. And, as if to drive home the lesson, the latest statement of the Ministry of Fuel and Power reveals that our entire coal production in 1946 is likely to have been in the region of four million tons short of total requirements. The cuts in existing allocations to industrial consumers announced this week, which may amount in some cases to 50 per cent, are in existing shortage conditions welcome evidence of the authorities preparedness to face unpleasant facts realistically, which it has not always done in the past. If as a result coal users can budget with some certainty on receiving a definite minimum supply, even though it is substantially smaller than their requirements and importance would warrant, the Ministry will have conferred a genuine benefit—one of few.

COST OF GO-SLOW

AT this time when man-power is so valuable, it is shocking to find that the " go-slow " movement of certain key workers at the Stratford loco works of the L.N.E.R. is continuing after many weeks. The Government is apparently taking a fatalistic attitude towards this strike, and permits thousands of London suburbanites to travel in grossly overcrowded conditions and lose precious hours of work in the process. It is our misfortune that we have to travel on a line affected by this " go-slow " strike. Many trains have had to be cancelled owing to lack of engines, and as a result in some cases a load of humanity which would normally have been carried in three trains has had to squeeze itself into one. Were animals subject to such conditions the perpetrators of the outrage would justifiably be prosecuted for cruelty. We have seen twenty-five human beings crammed into a box roughly eight feet by eight feet by five feet six inches. Because of train cancellations and overcrowding, journeys have taken almost twice as long as they should. During one of these movements " en masse " which we unwillingly participated in, we had ample leisure to ponder on the amount of time lost by this "civilised " way of travelling. Although our efforts at concentration were not helped much by the two passengers who failing any floor space to tread on were walking on our feet, nor by another who was half-sitting in our lap, we calculated that each train-load of people represented a wastage of 1000 man-hours. One has only to multiply this figure by the number of trains run during the rush-hour, and by the number of lines on which these conditions exist, to appreciate the enormous loss of man-hours by this small strike.

THE FISCHER-TROPSCH PROCESS*

Future Prospects of the Process

by C. C. HALL, Ph.D., M.Sc., F.R.I.C.†

THE process under consideration was discovered by Franz Fischer and Hans Tropsch of the Kaiser Wilhelm Institute for Coal Research, Mülheim, Ruhr, in 1925. They found that a mixture of carbon monoxide and hydrogen would react in the presence of iron, cobalt or nickel catalysts at temperatures in the range 180°-250° C., and at atmospheric pressure to form a mixture of aliphatic hydrocarbons ranging from methane to solid waxes and including substantial fractions boiling in the motor spirit and diesel oil range. During the ensuing years, Fischer and his co-workers continued their investigations. Experiments were carried out on a semi-technical scale and, mainly as a result of the development of more active cobalt catalysts, the yields obtained originally were greatly increased.

Petroleum-Like Products from Coal

This process, which provided a means of obtaining petroleum-like products from coal, had an obvious attraction for a country like Germany which was striving to achieve independence of imported petroleum oil, and in 1934, the Ruhrchemie A.G. of Oberhausen-Holten, Ruhr, undertook the task of putting the process into operation on the industrial scale. By 1936, this company had completed the erection of the first commercial unit and by 1939 a total of nine plants with an aggregate rated annual output of 740,000 tons of synthetic oil had been erected in various parts of Germany. The first plants to be erected were designed for operation at atmospheric pressure, but as a result of research work, both at the Kaiser Wilhelm Institute and by Ruhrchemie, certain of the later plants were built for operation at about 10 atm. pressure. Use of this so-called "medium-pressure" was intended to give increased yields and catalyst life but not to affect the essential characteristics of the original process.

The nine plants were in operation throughout the war until they were put out of action by bombing in the winter of 1944, the maximum annual output of oil amounting to rather less than 600,000 tons or about 8 per cent of the total German oil production. No new Fischer-Tropsch plants were erected during the war. The production of oil by the high-pressure hydrogenation of coal and tar, on the other hand, which was greatly expanded in Germany during the war, reached a maximum of 3,300,000 tons per annum or 45 per cent of the home oil production. This unequal expansion of the two processes was due to the fact that the hydrogenation process was more suitable for the production of the much-needed high-grade petrol and did, in fact, provide nearly all the aviation spirit made in Germany. Although the Fischer-Tropsch process made a useful contribution to German supplies of motor fuel and diesel oil, the lubricating oil, detergents and fatty acids prepared by further processing of the primary products were of relatively greater value to the war effort. Much of the research and development work carried out in the Fischer-Tropsch field during the war was concerned with the production and utilisation of primary products as raw material for the chemical industry.

Apart from one small plant in Northern France, erected under licence from Ruhrchemie, and a number of similarly licensed plants in Japan, industrial operation of the Fischer-Tropsch process has so far been confined to Germany. Research work on the process has been carried out for a number of years at the Fuel Research Station of the Department of Scientific and Industrial Research at Greenwich, and certain of the results obtained by the Germans for the cobalt-catalyst process have been independently confirmed and extended by work in the laboratory and on a somewhat larger scale.

U.S. Investigations

In the United States, an Office of Synthetic Liquid Fuels was established in 1944 in the Bureau of Mines, with a grant from Congress of $30,000,000, to investigate the production of petrol by synthetic processes, including the Fischer-Tropsch process. The programme includes the design, construction and operation of demonstration plants.

Stimulated by the existence in certain oil fields of large amounts of cheap, natural gas, which can readily be converted to carbon monoxide and hydrogen, the American petroleum industry has, during the last few years, carried out research on the Fischer-Tropsch process, and now claims to be in a position to produce petrol by an improved form of this process at a price competitive with the natural product. The most clearly defined development of this type, the "Hydrocol" process of Hydrocarbon Research Inc., has recently been described by P. C. Keith,[1] who states that the erection of a plant at Brownsville, Texas, to produce about 300,000 tons per year of high-grade

* From a paper presented to the Yorkshire section of The Institute of Fuel on December 18.

† Of the Fuel Research Station, D.S.I.R.

petrol will be completed by the end of 1947.

The effect of these recent American developments on the status of the Fischer-Tropsch process will be considered later under the heading of future possibilities. The present assessment of the process as a commercial proposition must be based on the operation of the German plants, in the light of the very complete information now available as a result of investigations carried out in Germany under the auspices of the CIOS and BIOS organisations.

The process consists, first, in the preparation and purification of the required mixture of carbon monoxide and hydrogen, known as "synthesis gas," secondly, in carrying out the synthesis reaction in the presence of the cobalt catalyst and, finally, in recovering and refining the primary hydrocarbon products. These stages in the process are illustrated by the simple flow sheet shown in Fig. 1. Table I gives the location sources of synthesis gas, type of process and maximum annual output achieved for the nine German plants.

The magnitude of this part of the process is indicated by the fact that an output of 60,000 tons per annum of synthetic oil required the daily production of about 45 mil. cu. ft of synthesis gas. As will be seen from Table 1, most of the plants used coke or coke together with coke-oven gas as raw material. This was mainly due to the fact that six of the plants were sited in the Ruhr area where surplus coke and gas were available, but the experience of these plants, compared with that of the two which obtained their synthesis gas by the complete gasification of brown coal, was that the gasification of coke in standard water-gas generators gave much less trouble in operation, gave a cleaner gas which was more readily purified, and was on balance the more economic method. The direct gasification of powdered brown coal by the Wintershall-Schmalfeldt process used at the Lützkendorf plant was particularly troublesome and due to the stoppages and the low-quality gas it produced, this plant never ex-

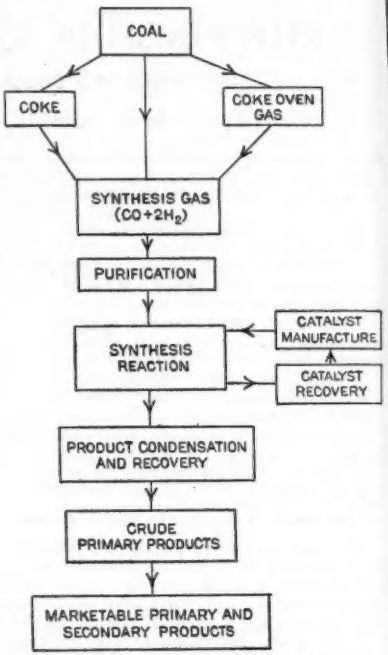


Fig. 1.—The Fischer-Tropsch process.

TABLE. 1.—*German Fischer-Tropsch plants*

Location	Source of synthesis gas	Type of process	Maximum annual output of primary products, metric tons
Oberhausen-Holten, Ruhr	Coke	Normal pressure and medium pressure	62,700
Moers-Meerbeck, N. Rhine ...	Coke and coke-oven gas	Normal pressure	73,300
Castrop-Rauxel, Ruhr	Coke and coke-oven gas	Normal pressure	40,400
Wanne-Eickel, Ruhr...	Coke (including l.t. coke) ...	Normal pressure and medium pressure	54,000
Bergkamen, Ruhr	Coke and coke-oven gas	Normal pressure	86,600
Dortmund, Ruhr	Coke	Medium pressure	51,000
Ruhland-Swarzheide, Nr. Dresden...	Brown coal briquettes (Koppers and Didier-Bublag processes) ...	Normal pressure	179,700
Lutzkendorf, Nr. Leipzig	Powdered brown coal (Schmalfeldt process)	Normal pressure	29,300
Deschowitz-Beuthen, Upper Silesia	Goke and coke-oven gas	Medium pressure	39,200

ceeded 40 per cent of its rated output of Fischer-Tropsch oil.

Where coke was used as the basic raw material the hydrogen to carbon monoxide ratio of the water-gas was increased to the required value of 2 : 1, either by partial conversion with steam over the "shift" catalyst or by adding the hydrogen-rich gas obtained by cracking coke-oven gas in the presence of steam.

The removal of sulphur from the gas, which is essential if rapid poisoning of the cobalt catalyst is to be avoided, was carried out in two stages. Hydrogen sulphide was first removed by the conventional method of passing the gas through layers of hydrated iron oxide and the organic sulphur then removed by three stages of treatment at 180-250° C. using granules prepared by pasting together 70 parts of iron oxide ("Lux" or "Lauta" masse) and 30 parts of sodium carbonate. When the gas entered this stage of treatment it contained 0.2 per cent of oxygen and in the process the sulphur was oxidised and retained in the contact mass as sodium sulphate. The total sulphur content of the gas leaving this stage was between 0.05 and 0.15 g. per 100 m^3 (0.02 – 0.06 gr. per 100 ft.^{3}).

If the synthesis process was to be operated under pressure the gas was then compressed to 10 atm., or otherwise was passed direct to the synthesis reaction vessels.

The Synthesis Process

The synthesis catalyst used in all the German plants from 1938 onwards had the approximate composition, in parts by weight : Co 100, ThO_2 5, MgO 8, kieselguhr 200, and was prepared by precipitation from the nitrates with sodium carbonate with the addition of kieselguhr. Before use in the process, the catalyst granules (1 to 3 mm. size range) were reduced in a rapid stream of pure, dry ammonia-synthesis gas (H_2/N_2 = 75/25) for a short period at about 400° C., and were then stored, transported and charged to the reaction vessels in an atmosphere of carbon dioxide. After use for a period varying between three and eight months the catalyst was discarded and the cobalt and thorium were recovered by digesting it with nitric acid and used in the preparation of fresh catalyst. These processes of catalyst preparation, reduction and recovery were carried out in special factories serving a number of Fischer-Tropsch plants. Thus, for example, the Ruhrchemie factory at Holten supplied all the catalyst required by the six plants in Western Germany, amounting to about 3000 tons per annum.

The synthesis reaction in the presence of a cobalt catalyst takes place over the temperature range 180-200° C., and is strongly exothermic (ca. 70 B.Th.U., per cu. ft. synthesis gas converted). To obtain the desired products and avoid excessive production of methane and the formation of carbon, the temperature must be rigidly controlled by adequate dissipation of the heat of reaction. In the German plants this was effected by arranging the catalyst granules in narrow spaces between cooling surfaces. For operation at atmospheric pressure a rectangular sheet-steel, box-like vessel filled with vertical steel sheets set about ¼-in. apart and traversed by horizontal water-cooling tubes was used. For operation at 10 atm. pressure, the catalyst was placed in a 10-mm. annulus between concentric tubes welded into tube plates at each end of a vertical cylindrical steel shell containing cooling water which also circulated through the inner tubes. Steam generated by the heat of reaction was collected in steam-chests fitted with pressure regulators which automatically controlled the temperature in the reaction vessels. Each type of vessel weighed about 50 tons when empty and had a catalyst capacity of three tons occupying a volume of about 360 cu. ft. For an annual production of 70,000 tons of synthetic oil about 100 reaction vessels of either type were required.

The process was carried out in stages, two for the atmospheric-pressure and three for the medium-pressure process, the heavier oils formed being condensed out from the gas stream between stages. The number of reaction vessels in each stage and the temperature, gas throughput and supply of fresh catalyst were controlled to obtain about 90 per cent conversion of the carbon monoxide and hydrogen and to distribute the load as evenly as possible over the stages. The overall space velocity (*i.e.*, for all stages) was between 60 and 70 volumes of gas (at N.T.P.) per volume of catalyst space per hour. The life of a charge of catalyst varied from three to eight months in the different plants operating at atmospheric pressure, and between six and seven months in the medium-pressure plants.

Recovered Products

The higher boiler reaction products were recovered by cooling the gases leaving the reaction vessels, in the atmospheric-pressure process by direct contact with water-sprays in packed towers, in the medium-pressure process by indirect cooling in tubular condensers. The low-boiling fractions, including the condensible C_3 and C_4 gaseous hydrocarbons were recovered by adsorption in active carbon. Methane and the small amount of ethane and ethylene produced remained behind in the residual gas together with unchanged carbon monoxide and hydrogen and the inert constituents of the synthesis gas.

The recovered products were fractionated and stabilised in conventional petroleum re-

fining equipment and the liquid fractions washed with alkali to remove the small proportion of fatty acids always formed in the synthesis.

As can be seen from Table 2 the yield of total primary products (C_3 and higher hydrocarbons) varied considerably, but in the last two or three years of operation four of the plants consistently obtained

TABLE 2.—*Performance data for German Fischer-Tropsch Plants.*

Performance data	Normal-pressure process	Medium-pressure process (9-11 atm).
Synthesis gas rate, vols. gas/vol. reaction space/hr. ...	50–72	60–71
Carbon monoxide converted, per cent.	82–94	91–94
Yield of total primary products— g./Nm³ CO + H_2	130–165	145–165
Production of total primary products, metric tons/reaction vessel/annum	400–780	660–850
Catalyst life in months ...	3–8	6–7

yields between 155 and 165 g. per N*m³ inert-free gas and a space-time yield of 750-850 tons per reaction vessel per annum (or, approximately 2½ tons per cu. ft. reaction space per annum).

The average composition of the primary product is shown in Table 3 from which it will be seen that operation under pressure caused an increase in the proportion of higher to lower hydrocarbons and in the proportion of paraffins to olefines. The low-boiling liquid fractions of the product consisted to an extent of over 95 per cent of normal straight-chain hydrocarbons but there is evidence (mainly of an indirect nature) that the high fractions and waxes contained a higher proportion of branched-chain isomers. The amount of methane produced was 14 per cent of the total hydrocarbons in the atmospheric-pressure process and 10 per cent in the medium-pressure process.

Utilisation of the Products

Most of the firms operating the plants sold the products in the form of the fractions shown in Table 3. The C_3 and C_4 gases, called in Germany "Gasol," were liquefied by compression and sold as a fuel, except in one case where the olefines were first removed by conversion into alcohols by the sulphuric acid hydration process. The low-grade petrol fraction (octane No. 45-50) was sold for blending with benzol to give a normal-quality petrol. Before the war, most companies had experimented with thermal-cracking plants to produce additional petrol from the higher fractions of the product, but the results were not promising and no use was made of these plants during the war.

The light middle oil formed an extremely high-quality diesel fuel and was sold for upgrading low-quality diesel oil from petroleum and tar. The heavy middle oil, or "Kogasin" as it was called, was nearly all sold to I.G., who hydrogenated it and treated it with sulphur dioxide and chlorine in the presence of ultra-violet light to produce sulpho-chlorides known as "Mersols" which were saponified and the sodium salts ("Mersolates") used to replace soap in washing powders. A portion of this fraction together with the oil and very soft wax obtained by the sweating process in wax refining was subjected by Ruhrchemie to thermal cracking and the olefines so obtained polymerised with aluminium chloride to produce good-quality motor lubricating oil.

Nearly all the soft wax produced was sold for the production of fatty acids by catalytic oxidation with air in the liquid phase. The oxidation was controlled to give acids in the range C_{10} to C_{20}, required for soap manufacture, as the main fraction, but the lower and higher fractions found a ready market for a variety of industrial uses—*e.g.*, in leather dressing, preserving cattle food, preparation of alcohols, solvents,

TABLE 3.—*Average composition of Fischer-Tropsch reaction products.*

	Normal-pressure process		Medium-pressure process	
	Weight, per cent of total	Olefines, per cent by vol.	Weight, per cent of total	Olefines, per cent by vol.
"Gasol" (C_3 and C_4 ...	14	43	10	40
Spirit, 30-165° C....	47	37	26	24
Middle oil, 165-230° C....	17	18	24	9
Heavy oil, 230-320° C....	11	8	13	—
Soft wax, 320-460° C....	8	—	17	—
Hard wax, over 460° C. ...	3*	—	10	—

*Extracted from the catalyst.

plasticisers, emulsifiers, greases and wire-drawing lubricants, and as modifiers in the preparation of glyptal resins. A small amount, about 150 tons per month, of the main fraction was esterified with glycerine and sold as edible fat. It is by no means certain, even on German physiological evidence, that this fat was really suitable for human consumption and its use must be regarded as an example of the lengths to which the Germans were forced to go in maintaining supplies of edible fats.

The hard wax fraction in the main was either sold direct to wax refiners or

* 0° C., 760 mm., dry.

blenders or, in the case of Ruhrchemie, first of all refined and separated into several grades. It was used in the manufacture of polishes, and electrical insulating materials, for the impregnation of paper, etc. In two cases the crude hard wax extracted from the synthesis catalyst was oxidised with air in the absence of catalysts, and the resulting crude mixture of unchanged wax, fatty acid and other oxygen-containing substances was sold at a high price as an emulsifiable wax under the names "Emulgierwachs P.S." and "Parestol." It was used in the preparation of emulsion paints and emulsion polishes and as a water-proofing agent in the textile industry.

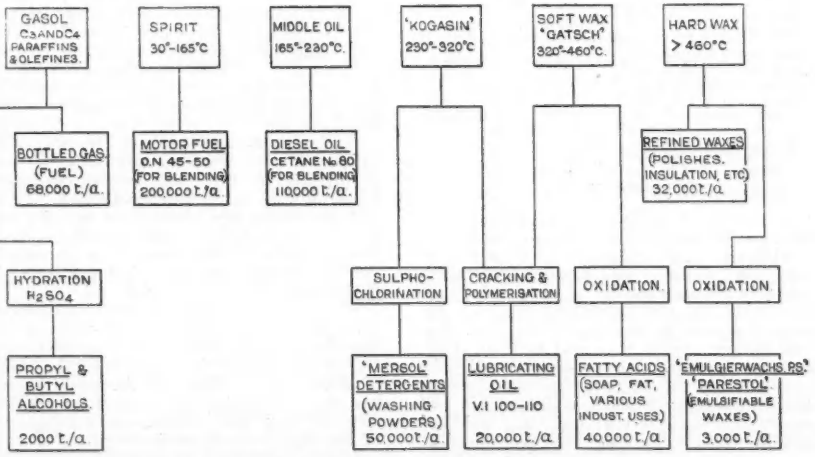
The utilisation of the products is summarised diagrammatically in Fig. 2 which gives the approximate annual production of the main final products. It will be seen from this that about 72 per cent of the total products were used as fuels and 28 per cent as chemical and special products.

Thermal Efficiency of the Process

It can be seen from Table 4 that between 23 and 30 per cent of the total heat input was recovered in the form of primary products, but the percentage of the heat input recovered in useful form amounted to 55 per cent for the most efficient German plant (Bergkamen). The net heat consumed in the production of one gallon of primary products in this case was 3.82 therms or expressed as coal of 12,600 B.Th.U./lb. (assuming 90 per cent thermal efficiency for the carbonisation of coal); about 4.5 tons of coal per ton of primary products. The steam recovered from the reaction vessels together with that obtained from the waste-heat boilers of the water-gas generators was more than sufficient for the entire needs of the process, and the residual gas from the synthesis supplied all the fuel requirements. The electricity consumption in the atmospheric-pressure process was small (less than 3 per cent of the total energy required calculated as heat energy), but was appreciably greater (15 per cent of the total heat energy) in the medium-pressure process.

The capital cost of most of the German plants was in the range 500 to 600 RM. per ton annual output and the operating cost, including amortisation and interest on capital, varied between 230 and 390 RM. per ton of primary products. The operating costs for the two most efficient plants are set out in Table 5, to show the contribution of the various items, raw material, wages, capital charges, etc., to the whole. In Table 6, data for the Bergkamen plant are set out to show the division of the total cost between the various operations making up the whole process. The data in Table 5 show that raw materials and capital charges were the largest items and that cost of cobalt catalyst replacement was a comparatively minor item. The method of expressing the costs in Table 6 shows very clearly that the manufacture of the synthesis gas accounted for over 50 per cent of the total cost. It was for this reason that the plants were operated to give maximum conversion of synthesis gas to primary products rather than maximum space-time yield. It will be noted from Table 5 that,

Fig. 2.—Utilisation of products of the Fischer-Tropsch process.



LIQUID FUELS 378,000 t./a. (72%). CHEMICAL AND SPECIAL PRODUCTS. 147,000 t./a. (28%)

although at the periods for which data are given, the two plants were operating at the same high conversion level (164 g. per m^3) the medium-pressure process was the more costly. The difference in costs between the two process (2.1 Rpfg. per kg.), however, was compensated for by the high sales value of the hard wax. The price obtained for the lower fractions was of the order of 25 to 30 Rpfg. per kg. whereas the hard wax sold for 60 to 70 Rpfg. per kg. It can thus be calculated from the product compositions given in Table III that the total sales value of the medium-pressure primary product

TABLE 4.—*Thermal balance for the Fischer-Tropsch process.*

Plant	Bergkamen	Oberhausen-Holten
Process	Normal pressure	Medium pressure
Monthly production of primary products, metric tons	6,842	3,865
Yield of primary products: g./Nm^3 CO + H_2 ...	160.3	140.6
Heat Input— (Kg. cal./Kg. primary products)—		
Coke	24,078	40,164
Coke-oven gas ...	11,578	—
Electricity ...	1,037	7,616
Steam	1,370	2,236
Total	38,063	50,016
Heat Recovered— (Kg. cal./Kg. primary products)—		
Primary products ...	11,260	11,260
Residual gas... ...	7,627	3,775
Steam	2,210	2,804
Loss	16,966	32,177
Total	38,063	50,016
Heat recovered, per cent of input...	55.6	35.7
Heat recovery in primary products, per cent of input	29.6	22.5
Net heat consumed in the production of 1 Kg. primary products. Kg. cal.	28,226	43,437
Equivalent coal consumption tons/ton primary products	4.50	6.89

Conversion factor: 1 Kg. cal./Kg. = 1.8 B.Th.U./lb.

was about 2.8 Rpfg. per kg. higher than that of the atmospheric-pressure product.

Although it is not easy to translate German wartime costs into present-day British costs, in the case of the process under consideration, the cost of making synthesis gas is such a high proportion of the total that the attempt should be worth making. German raw-material costs cannot readily be converted, but if the cost of coke for water-gas manufacture is taken as £3 per ton and other costs converted on the basis of 10 RM. = £1 (which has been recognised as a reasonable one for converting German wartime costs to present-day British ones) then the total production cost for the medium-pressure process as operated in Germany would be £32 per ton or 2s. 1½d. per gallon of primary product. This is probably an optimistic estimate.

The value of the product in this country cannot be assessed accurately, but assuming that it was disposed of as in Germany the revenue obtainable for 1 ton of primary product might be somewhat as follows:

	Revenue...£
0.10 tons liquefied gas at £10/ton	1.0
0.50 tons petrol and Diesel oil at £18/ton... ...	9.0
0.13 tons "Kogasin" at £30/ton	3.9
0.17 tons "Gatsch" (soft wax) at £28/ton ...	4.8
0.10 tons hard wax at £60/ton	6.0
Total revenue from 1 ton primary products ...	24.7
Total cost for 1 ton primary products	32.0
Deficit...	£7.3

The value taken for "Kogasin" is based on the price paid for it by I.G. (30 pfg./kg.) as raw material for the manufacture of "Mersol," and that for the soft wax on the price paid for it by Deutsche Fettsäure Werke (275 RM./ton) for use in the production of fatty acids. The price taken for the hard wax is an estimated one based on the reasonable assumption that it is a more valuable product than imported paraffin wax priced at £45 per ton. In Germany, the unrefined hard wax sold for about 600 R.M./ton and the refined material for 900 RM./ton, the refining cost being about 100 RM./ton.

If the soft wax at £28 per ton was converted into fatty acids by oxidation, the cost of production of one ton of fatty acids would be at least £65, based on the German cost for the oxidation process (225 RM. per ton of wax oxidised) and the maximum yield of acids obtained in German practice (78 per cent of the wax oxidised). This is a high price for a complex mixture of saturated fatty acids ranging from C_2 to C_{22}, no fraction of which is really suitable for the manufacture of toilet soap or edible fat.

No information is available for the costs of the Mersol process, but although the production of this soap substitute might be profitable using Fischer-Tropsch oil at £30 per ton as raw material, it would probably be even more profitable using a fraction of imported petroleum oil at about £10 per ton, despite the fact that the latter is a less suitable raw material.

If the Kogasin was used as raw material for the production of lubricating oil by cracking and polymerisation, the cost of a ton of lubricating oil would be of the order of £80 based on the Ruhrchemie yield (45 per cent conversion of Kogasin to lubricating oil) and their average processing cost of 150 RM./ton of lubricating oil.

The conclusion therefore is that the operation of the Fischer-Tropsch process in

this country on the tried and proved German lines would not be an economic proposition.

In order to make the Fischer-Tropsch process an attractive economic proposition improvements must be made in one—or preferably in all—of the following directions. First and foremost, the cost of preparing synthesis gas must be drastically reduced. The synthesis process must be improved either in the direction of increased space-time yield or by the production of products more valuable as raw material for the chemical industry. Further applications must be found for the products. The research and development work carried out in Germany during the last six years has resulted in improvements in certain of these directions and recent American claims indicate improvement in others.

Cheaper Synthesis Gas

The prime requisite for cheap synthesis gas is cheap raw material and in this respect we in Great Britain are at a disadvantage. In the United States, natural gas is available—for example, in Texas, at 5 cents/1000 cu. ft.—and there are large deposits of sub-bituminous coal which can be delivered at a works for between one and two dollars per ton. In several parts of the British Commonwealth cheap low-rank coal is available. In these cases cheap synthesis gas is already possible and under suitable circumstances the Fischer-Tropsch process as operated in Germany would be an economic proposition.

For this country the only hope of obtaining relatively cheap synthesis gas lies in the direct gasification of some low-grade non-caking slack or in underground gasification of coal. Although a number of processes for continuous gasification of small-size coal with oxygen have been developed in Germany, they were primarily designed to treat brown coal and their applicability to bituminous coal is uncertain. Furthermore, in all such processes the cost of oxygen becomes an important factor. The Lurgi Company carried out full-scale trials of the pressure gasification with oxygen of a non-caking bituminous coal and made cost estimates. With coal at 14 RM. per ton they estimated a cost of 1.41 Rpfg. per Nm.³ synthesis gas ($H_2 : CO = 2 : 1$) compressed to 9 atm. and washed free of CO_2. This certainly compares favourably with the figure of 2.3 Rpfg. per Nm.³ for gas in a similar state, prepared from coke at 17.8 RM. per ton at the Dortmund Fischer-Tropsch plant, but estimates of this sort must be accepted with reserve.

According to Russian work, gas suitable for synthesis can be produced by underground gasification at between ⅓ and ¼ of the cost by normal methods. If experiments with this technique could be carried out in this country they would be of considerable interest from the point of view of the present discussion.

On the whole, the Germans made very little progress in increasing the efficiency of the process. They found that by subjecting the spent cobalt catalyst to reduction in hydrogen, the recovery of the catalyst by solution in acid could be delayed for a period of about two years—an observation which was confirmed by the author at the Fuel Research Station in 1941. As the cost of catalyst replacement on the present

TABLE 5.—*Working costs of the Fischer-Tropsch process (Rpfg. per Kg. total primary products)*

Plant	Bergkamen	Dortmund
Process	Normal pressure	Medium pressure
Yield, g. total prim. prod./m³ $CO + H_2$ ...	163.5	164.5
Production, metric ton/month	7,000.0	4,272.6
Date	April, 1944	January, 1942
Cost item	*Rpfg/Kg.*	*Rpfg/Kg.*
Raw materials		
Coke	7.70 (1)	7.80 (3)
Coke-oven gas ...	4.75 (2)	—
Fuel, power and water ...	2.46	5.35
Wages and salaries ...	1.08	1.20
Materials—		
Cobalt catalyst ...	1.71	1.90
Other materials ...	0.71	1.15
Repairs and maintenance	0.42	1.60
Various costs	1.77	1.98
Total	20.60	20.99
Credits, Steam and residual gas ...	4.37	3.48
	16.23	17.51
Capital charges	7.48	8.31
Total working costs ...	23.71	25.82

(1) 3.72 Kg. at 20.68 RM./ton.
(2) 2.5 m³ at 1.90 Rpfg./m³.
(3) 4.38 Kg. at 17.79 RM./ton.

method of working is a comparatively small item, however, this improvement will not materially affect the economics of the process.

The use of iron catalysts, the study of which represented a very large proportion of the German research effort, while of interest in other directions, to be discussd later, offers little prospect of effecting a reduction in operating costs.

It is, in fact, unlikely that a material degree of cost reduction will be brought about solely as a result of catalyst improvement. The most costly feature of the German process is the large number of complicated reaction vessels required for a given output of products.

In the German method of carrying out the process, the necessity for controlling the temperature to within a few degrees requires that the temperature difference between the catalyst granules and the cooling surface shall also be small, and it can easily be calculated, as P. C. Keith has done,[1] that

under such conditions the required ratio of cooling surface to catalyst volume and the upper limit of space velocity must necessarily be of the order of those used in the German plants.

In discussing the limitations of the German method, Keith states: "there can be no question that catalyst activity has seldom been the limiting factor. More often it has been the efficiency of removal of the heat of reaction. In other words, with adequate heat removal, the space-time yield of oil is potentially greater than anything that has ever been realised." This is not strictly true. Admittedly, it was found that the space velocity through a full-scale German reaction vessel could not be increased much beyond 100 per hour without getting local overheating of the catalyst, but the use of an overall space velocity of only 60 to 70 arose from the desire to obtain as high a conversion as possible of the very expensive synthesis gas. The actual choice of space velocity, therefore, was due to the limitations of catalyst activity and not those of heat removal.

TABLE 6.—*Working costs of the Fischer-Tropsch process (Rpfg./Kg. total primary products).*

Plant	Bergkamen
Process	Normal pressure
Cost item	*Rpfg./kg.*
Production of synthesis gas	13.25
Purification of synthesis gas	2.45
Synthesis of primary products ...	6.55
Recovery and refining of primary products	1.46
TOTAL COST	23.71

In the more efficiently cooled reaction vessels which can be used on a laboratory-scale, we have found in our experiments at Greenwich that space velocities as high as 500 per hour can be used even with a cobalt catalyst of higher activity than that used in the German plants, without overheating the catalyst. Under these conditions the space-time yield was barely twice that obtained at a space velocity of 100 per hour; the conversion of the carbon monoxide was only 40 per cent of that at the lower rate and the catalyst deteriorated much more rapidly.

Unorthodox Experiments

The Germans did make some experimental departures from the "orthodox" method of carrying out the process. The I.G. tried out a method in which internal water-cooling was entirely dispensed with and the heat of reaction was removed by recirculating the residual gas through the catalyst bed at 100 times the fresh gas input rate, the recycle gas being cooled and stripped from reaction products before re-entering the reaction vessel. A robust "sintered" iron catalyst was employed at 325°C. and at 20 atm. pressure. Although the space-time yield obtained in experimental runs was higher than that obtained in the Ruhrchemie process and the main product was 70 octane petrol, when the costs were calculated they were found to be slightly higher than those for the orthodox process, based on a ton of 70 octane petrol in both cases (*i.e.*, the cost of converting the primary product to petrol had to be added to the normal costs of the Ruhrchemie process). This was due to the high power cost for the gas circulation, the expense of recovering products from large volumes of hot gases and the high methane production in the process.

Several German organisations experimented with the use of finely powdered iron catalysts dispersed in high-boiling oil through which the synthesis gas was passed. The conversions and space-time yields obtained in these liquid-phase processes were somewhat better than those for the normal process, but difficulties such as the formation of crusts of catalyst and ferrous carbonate on the walls of the vessel had not been overcome. The reaction vessel for such a process can be quite simple in design — a cylindrical tower fitted with a water-cooling coil—and in consequence can be made very much larger than the conventional type. It was claimed, for example, that only ten vessels would be required for an output of 70,000 tons per annum instead of about 100 normal-type vessels.

Promising Method

In another experimental arrangement, the heat of reaction was removed by circulating oil through a bed of granular catalyst, the hot oil giving up heat in a waste-heat boiler before recirculation through the catalyst. This method gave conversions as high as the normal and about twice the normal space-time yield. Both this and the method of suspending powdered catalyst in oil appear to be worthy of further study.

None of these lines of attack, however, appear to promise a reduction in costs of the order claimed for the new American developments. In the "Hydrocol" process, for example, Keith claims that, using natural gas at 5 cents per 1000 ft.^{3} as raw material, he can produce 80-octane petrol (75 to 80 per cent of the total products) for a total cost of 5.25 cents per U.S. gallon. The process consists in partial combustion of the natural gas with oxygen at 250 lb. pressure to give a mixture of carbon monoxide and hydrogen which is then converted to liquid hydrocarbon using a "cheap, rugged iron catalyst" in a fluidised state. In this fluidised-catalyst technique, which was developed so successfully during the war for catalytic cracking of petroleum oils, a bed of finely powdered catalyst is maintained by the gas stream in a state of tur-

bulence resembling a boiling liquid. Keith claims that by using this technique the space-velocity limitation of the German method can be overcome while maintaining gas conversions of over 90 per cent. He implies that the whole advantage of the technique lies in the greatly improved heat dissipation obtained, but in view of what has been said earlier concerning the limits of activity of granular cobalt catalysts maintained in a fixed bed, a factor of increased catalyst activity or more probably "surface availability" also appears to be involved.

From the quantity and cost of the natural gas and oxygen stated by Keith (*loc. cit.*) to be required, it can be calculated that the total cost of converting the synthesis gas into finishing 80-octane petrol cannot be much more than 2 cents per U.S. gallon or about 1½d. per Imperial gallon. This compares with about 8½d. per gallon for the German process. Taking the cost of producing synthesis gas from British coke as 17d. per gallon of Fischer-Tropsch petrol, assuming that the yield per m³ will be the same in Keith's process as in the best German practice (*i.e.*, 160-165 g.), then the total cost of the petrol using Keith's process would amount to 18½d. per gallon. This would still not compete with imported petrol, but although the full composition of the product has not been disclosed, it is believed to be very rich in olefines and might therefore be used for the synthesis of more valuable chemical products.

It remains to be seen whether the claims made for the "Hydrocol" process will be justified by the performance of the plant planned for erection in Texas.

Modifications of the Product

Most of the German research work was directed towards obtaining primary products more suitable for conversion into chemical and special products. The aim was to obtain products rich in long-chain α-olefines for conversion to high-grade lubricating oil or alcohols, or rich in wax for conversion into fatty acids or containing a high proportion of primary alcohols for the manufacture of detergents and plasticisers.

With the usual cobalt-catalyst it was found that the olefine content of the 200-320°C. fraction could be increased to 45 per cent by using water-gas ($H_2 : CO = 1.25 : 1$) as raw material in the medium-pressure process and recirculating two to three parts of residual gas for each part of fresh gas introduced. By substituting manganese dioxide for the usual thoria and magnesia activators it was claimed that catalysts could be prepared which were active at 160 to 170°C. under medium-pressure conditions and which gave products containing over 50 per cent of wax.

It is, however, by the use of iron catalysts that the greatest variation in product composition is possible. This is to some extent due to the wide range of reaction conditions which it is possible to employ. Thus, by using a sintered iron catalyst at 225°C. and 20 atm. pressure with water-gas as raw material the I.G. obtained products consisting to the extent of 78 per cent of hydrocarbons distilling below 200°C. containing 70 per cent of olefines. Only 1 per cent of wax was produced.

By using a more conventional type of precipitated iron catalyst with kieselguhr as carrier and operating at 218°C. and 10 atm. pressure with water-gas, Ruhrchemie obtained products containing 55 to 65 per cent of wax.

In the I.G. "Synol" process an alkalised, melted-iron catalyst as used for ammonia synthesis was employed at 190 to 220°C. and 20 atm. pressure with gas richer in carbon monoxide than water-gas ($H_2 : CO = 0.75 : 1$). This process gave a product containing about 50 per cent of straight-chain primary alcohols, distilling mainly in the range 150 to 300°C.

These examples represent the extremes of variation achieved. Within these limits, by the use of varied catalysts and conditions, almost all possible variations of boiling range, olefine, and alcohol contents were obtained. The processes had only been tried out on an experimental scale, but in such tests the yields obtained in many cases were of the same order as those for the large-scale cobalt catalyst process.

Ruthenium Catalyst

Two other processes, both studied on a laboratory-scale at the Kaiser Wilhelm Institute Mülheim, are worthy of mention. Fischer and his co-workers found that at pressures of 100 atm. or higher and at temperatures of 190 to 200°C., ruthenium was a very active and long-lived catalyst for the synthesis of high-molecular weight hydrocarbons from water-gas. The products contained 60 per cent of very hard wax (m.p. 118 to 120°C.) from which fractions melting at 130°C. with molecular weights of the order of 20,000 could be extracted. If sufficient ruthenium could be made available this process might have a future as a means of obtaining polythene-like substances from water-gas.

In what Fischer termed the "Iso synthesis," water-gas was passed at 300 atm. pressure and 450°C. over mixed-oxide-catalysts (*e.g.*, $ThO_2 + Al_2O_3$) to give *iso*-butane as the main product. At low temperatures and higher pressures, alcohols (chiefly *iso*-butyl) predominated, and at higher temperatures, low-boiling aromatic and naphthenic hydrocarbons appeared in the products. As a means of producing *iso*-butane or aromatic and naphthenic hydrocarbons, this process does not seem to

be of great technical interest, but further research aimed at the production of a range of alcohols might be worth while.

Owing to the acute shortage of natural fats in Germany, every effort was made to increase the production of synthetic fatty acids, and the increased yield of wax obtained in some of the modified processes discussed above was therefore regarded as a very desirable feature. Detergents, particularly of the sulphonated primary alcohol type, were also in great demand for the same reason. The development of the "OXO" process by the Ruhrchemie A.G. made possible the production of the required type of alcohols from Fischer-Tropsch olefines. In this process olefines react with carbon monoxide and hydrogen in the presence of cobalt catalysts at 130° to 150°C. and 150 atm. pressure to give aldehydes. If the water-gas is then replaced by hydrogen and the temperature raised to 180°C. the aldehydes are converted into the corresponding primary alcohols. By the end of the war, an "OXO" plant to produce 12,000 tons of C_{12} to C_{18} alcohols per annum from C_{11} to C_{17} Fischer-Tropsch olefines was nearing completion at the Oberhausen-Holten works. It was estimated that the total cost of production of alcohols in this plant would amount to 780 RM. per metric ton based on a price of 400 RM. per metric ton for the olefines used as raw material.

The alcohols or aldehydes can be readily converted into the corresponding acids and hence this process can be used as a means of introducing the

$$CH_2OH, \; -C\begin{matrix}H\\ \diagdown\\ \diagup\\ O\end{matrix} \quad \text{or} \quad COOH$$

grouping into a wide range of pure compounds or technical materials containing an ethylenic linkage.

It is clearly impossible in the present paper to attempt to work out in detail the effect on the economics of the Fischer-Tropsch process of applying the results of these developments in product modification and utilisation.

It can be assumed, however, that the cost of preparing the primary Fischer-Tropsch product will not differ appreciably from that estimated above for the normal cobalt-catalyst product, and as with the modified processes, the proportion of the product which can be utilised as "chemical raw material" is very much higher, the proportion which must be disposed of at a low price as fuel is correspondingly less, and the prospects for economic operation are in consequence materially improved.

It must be borne in mind, however, that whereas the operation of, say, one 80,000 ton per annum Fischer-Tropsch plant producing, for example, hard wax, fatty acids and alcohols as the main products might be a paying proposition, it would depend for its success of the "scarcity value" of such products and the erection of further plants would inevitably cause a fall in their market value. It is also clear that the chemical products selected for manufacture from the Fischer-Tropsch oil must not be of the type which can equally readily be manufactured from petroleum. This, in general, means avoiding the simple C_2 to C_5 compounds and taking full advantage of the essentially straight-chain character of Fischer-Tropsch primary products.

The position can be summed up as follows:

The operation of the Fischer-Tropsch process in this country based on the performance of the most efficient German plants, would be uneconomic. This is mainly due to the high cost of synthesis gas, but partly to the inefficiency of the synthesis process itstlf and partly to the fact that a high proportion of the product is only utilisable as liquid fuel.

Even with the application of all foreseeable improvements in synthesis gas manufacture and synthesis process technique there seems little prospect of utilising the Fischer-Tropsch method for the economic production of liquid fuels in this country. If, however, the process is operated along the lines of German research and development work to produce the maximum possible amount of high-priced chemical and special products, a limited industrial application of the process might prove to be economic. If, in addition, some reduction can be effected in the cost of synthesis gas and American claims for improved efficiency in the synthesis process prove to be justified and are not restricted to production of petrol as the main product then the process has an attractive future as a source of aliphatic chemical products. The prospect is at least sufficiently encouraging to justify continued research on the process and products up to and including pilot-plant operation.

REFERENCE.

[1] Gasoline from Natural Gas. Keith, P. C., *Oil and Gas Journal*, 1946, 44, 102 to 112.

British Institute of Management

The Board of Trade announces that the following have accepted the invitation of the President of the Board to serve on the first Council of the British Institute of Management, of which the Chairman will be Mr. C. G. Renold: Sir Clive Baillieu (Dunlop Rubber Co., Ltd.), Sir Archibald McKinstry (Babcock & Wilcox, Ltd.), Messrs. W. B. D. Brown (Glacier Metal Co., Ltd.), G. Cheliotti (General Electric Co., Ltd.), J. E. Myers (Municipal College of Technology, Manchester), C. N. Potter (Ilfords, Ltd.), John Ryan (Metal Box Co.).

RUSSIAN CHEMICAL INDUSTRY

GREAT EXPANSION PLANNED

THE programme in Russia for the five years ending 1950 includes not only reconstruction on a huge scale to make good the ravages of war but a considerable amount of new development. Prior to 1940, about 60 per cent of Russian chemical industry was centred in and around Leningrad and Moscow, 10 per cent in the Ukraine, and only about 4 per cent in the Caucasus and Crimea. It therefore suffered heavily from German occupation and much valuable plant was transferred to Germany.

A basic factor in reconstruction is, of course, the supply of steel. Output of this fell to 18.3 million tons in 1940 and to 15 million tons in 1945. By 1950 it is intended to increase steel output to 24.4 million tons, and within the same period it is intended to raise the chemical industry output 50 per cent above pre-war level. Considerable progress had already been made under the earlier plans in districts not touched by the Germans. Indeed, apart from war-time strategy and needs, large extensions of the chemical industries into eastern Russia and Siberia were already in progress.

Fertilisers figure largely in the five-year programme, especially superphosphate, output of which is to be doubled and reach something like 5 million tons plus 400,000 tons of ground phosphorite. Nitrogen fertilisers are to be raised by 80 per cent, and potash by 30 per cent. The U.S.S.R. possesses two-thirds of the world's total of phosphate. It is considered of the utmost importance that farmers, both individual and co-operative, should increase their consumption of fertiliser to the utmost, and every encouragement to this end is being provided, including plentiful supplies of mechanical distributors on the farms.

Synthetic Fuel

In the organic and synthetic branches of Russian chemical industry there will be several new developments, partly based on coal and petroleum as raw material, including plastics, rubber, and synthetic textiles. And, although Russia is the world's second largest producer of petroleum, it is intended to devote special attention to synthetic fuel oil, since many of the oil-wells suffered serious damage during the war, and new fields, *e.g.*, Volga-Ural, have not come up to expectations. Therefore 900,000 tons of synthetic petrol annually is the target aimed at. Output of natural oil in 1950 is expected to be only about 14 per cent above that of 1940. Production of synthetic rubber is to be doubled and would then represent some 38-40 per cent of the present world total.

In the field of synthetic fibre, production of rayon, at all events, is to be at least four times that of pre-war, largely through enhanced yield of viscose cellulose. Three new rayon factories are to be built, and four for other fibres, construction of which was interrupted by the war. Some attention also will be given to synthetic tannins and artificial leather.

Forest Products

Important industries and developments will be based on Russia's enormous forest resources, *i.e.*, production of ethyl alcohol, acetone and derivatives, pulp and paper, sulphites and derivatives, resin, turpentine. But not very much is said about the nearly related field of oils and fats, including sunflower seed oil which used to be reckoned in millions of tons per annum, to say nothing of other products from the crop, such as potash. Much of the oil used to be hardended (hydrogenated) and used for soap and margarine. In fact, however backward Russian chemical industry may have been years ago, she was one of the pioneers in fat-hardening and quickly realised the economic importance of this new process (about 30-35 years ago). Since oils and fats are among the most important in any country's economy to-day it is hardly likely they have been overlooked. The manufacture of soap is to come very near the million ton mark by 1950, as compared with 495,000 tons in 1937 and 800,000 tons in 1940. So far as possible, fat substitutes will be used, *i.e.*, synthetic fatty acids and soap-naphtha, in order to reserve as much as possible of the natural oils and fats for food.

Production of alkalis, sulphuric acid, and other heavies will, of course, be augmented to a high degree. Caustic soda will be 390,000 tons in 1950, and soda ash 800,000 tons. Similar increases will take place in pharmaceuticals, paints, varnishes, dyes, etc.

A Ministry of Chemical Industry has been established, and the present chief of that department is Michael Pervoukhin. The centres of all this chemical activity will be widely dispersed, but a large share will be found in Siberia, the Ural districts, Russian Turkestan, Ukraine, many of them based on local natural resources, such as the potassium and magnesium salts and other minerals of the Urals, the rich coal beds of Kouznetsk in Siberia, the huge sulphur deposits—in seams 45 metres thick—of Kara Tau, and so on.

Digest of Statistics

Rising Consumption of Chemicals

EVIDENCE of the rising tide of production and consumption of chemicals and fertilisers in the U.K. in September and October and, where the figures are available, November is provided by the December issue of the *Digest of Statistics* (H.M.S.O., 2s. 6d. net). Stocks generally were slightly depleted. The accompanying figures represent thousand tons.

A fairly sharp reduction is shown in the stocks of sulphuric acid, which in August were 88.7, and in September 81.7, and had fallen in October to 77.1, by far the lowest level in the records since 1940. Production, however, showed a rapidly accelerating increase, having risen from 150.4 in August to 151.4 in September and to 164.4 in October. Consumption of sulphuric acid (as 70 per cent acid) was on the same increasing scale, 154 in August, 158 in September, and 170 in October. Consumption of sulphur for sulphuric acid production reflected the same tendencey, although not to the same extent, having risen from 15.7 in August to 16.8 in September, and 18.2 in October. Stocks of sulphur were rather depleted by October, at 62.2, a reduction of 6.5 on the September figure, and of 6.4 on that of August.

Agricultural Chemicals

Production of superphosphates was on a substantially increased scale in October, totalling 8504, 10.4 greater than in August (75.0), and 10.7 more than in September. Consumption of superphosphate also increased on a smaller scale: from 83.7 in August to 86.9 in October, but there had been a seasonal setback to 80.5 in September. Production of compound fertilisers was substantially diminished in September at 102.8, as compared with August's 112.3, but in October had made a fair recovery at 111.6. The rate of consumption correspondingly increased, from 55.9 in August to 76.5 in September, and 81.5 in October, an overall increase of 25.6. The use of phosphate rock for fertilisers was also on a rising scale, October's figure of 69.3 being 9.8 more than in August; in September there had been a slight reduction, at 59.4.

There was a marked increase in September in deliveries of ammonia to home consumers and exports during September, when the total of 30.10 represented a rise of 6.76, but the rate of consumption was not maintained by the October total of 23.56. These figures, however, do not include ammonia produced as a by-product and converted directly into ammonium sulphate.

The figure for iron ore production in October, 230, representing the average over noted in the previous month, but a considerable reduction was noted in November, when the total of 222 was slightly lower than the figure for August. Pig-iron production showed the same reaction, increasing from 145 in August to 147 in September, with a steep rise to 156, being the average of five weeks, in the October period. The figure for November, 222, represented a slight setback in production.

Production of steel ingots and castings were on a similarly increased scale, averaging 254 in the five-week October period, as against 238 in the previous month, and production was raised a further 10.0 (264) in November.

Heavy Demand for Copper

The same rising curve is reflected in the consumption figures of non-ferrous metals, total disposals of virgin copper rising in September from 25.0 in the previous month to 29.6, and in October to 32.0—a total increase in the eight weeks period of 28 per cent. This enlarged demand, however, did not overtake the rate of replacement, stocks in September totalling 94.7, 9.6 higher than in August, and in October 87.5. Disposals of virgin zinc in September, 19.4, were 2.7 heavier than in August and the figure rose in October to 21.6. Consumption of zinc concentrates showed a corresponding increase, from 11.6 in August to 13.7 in September and 15.8 in October; stocks were depleted to 108 in September (against 118 in August) and declined progressively to 105 in October.

The rising consumption of refined lead, after a slight drop in August, is reflected by the figures of 17.9 in September (+1.8) and 18.0 in October; the stock position showed a sharp reduction in September (19.8 against 27.1), with some recovery in October (22.4). Total disposals of tin metal, which had shown marked fluctuation in the July-August period, rose slightly to 2.84 in September (against 2.13 in the previous month) and were 2.64 in October.

The steady rise in the employment position is shown in the return of workers in chemical and allied industries: in September 233.4 (in thousands)—+0.6—and in October 234.7, of whom 82.2 were women.

Asbestos shipments from Southern Rhodesia in September, valued £272,448, were the third in order of importance of the Colony's exports for the month, total value of which were £2,439,609, the third largest ever recorded. In the same month, chrome ore exports were worth £69,675 (against £29,133 in August).

Control of the Chemical Industry

By Our Legal Correspondent

REFERENCE was made in THE CHEMICAL AGE last week to the Supplies and Services Act and the very wide regulations issued under it. The purpose of this article is to examine these regulations to see how far they have been altered from the Defence Regulations, with which we were familiar during the war, and then to examine the Orders issued under the Act in the past year which affect the chemical industry.

The very wide powers given to the government during the war have not been curtailed, but rather have been given a new direction. Every single regulation affecting the control of industry has been altered to some extent. In some cases entirely new regulations have been inserted.

The widest of all is the amended regulation 55 which provides the government with sweeping powers to control industry. This has been amended and it now gives a competent authority power to provide by Order

" (a) for requiring or prohibiting the production, treatment, keeping, storage, movement, transport, distribution, disposal, acquisition, use or consumption of articles of any description.

" (b) for regulating the carrying on of any undertaking engaged in essential work."

A " competent authority " means those Ministries which are interested in the production or disposal of commodities. "Essential work " means work connected with supply of goods or services essential to the wellbeing of the community, or essential for demobilisation or resettlement or essential for the conversion of industry and commerce to peace from war. No closer definition than this has yet been given and I do not know of any case in which the Courts have been asked to supply one. So far as the chemical industry is concerned this regulation seems clearly to be essential for the well-being of the community.

Orders which are issued may relate to a single undertaking, or, as is much more usual, to a class of undertakings. The competent authorities also have powers to introduce schemes of control and impose systems of licensing as may appear to them to be necessary. They may direct an undertaking to employ certain persons or a certain class of person. Where, as in the case of many public utilities, the charges are fixed by statute, they may give permission for the standard charge to be raised. They may appoint a Controller of the whole or part of an undertaking.

Very heavy penalties are introduced for breach of this regulation. On summary conviction one year's imprisonment and a fine or £500 may be imposed, on trial by indictment fourteen years and a fine of £5000. The maximum fine may be increased in large transactions to three times the improper price charged.

Appointment of Directors

During the war years the government had certain powers to appoint directors in private firms. A new regulation has now been substituted for the old regulation dealing with this matter. It applies only to essential production undertakings, that is, undertakings concerned with the supply of articles for the use of the Armed Forces or with supplies and services necessary for the purposes of the Act.

A competent authority has power to appoint additional directors of such a firm, if it is satisfied that this is expedient for the purpose of improving efficiency. But it may do so only where a substantial amount of public money has been, or is proposed to be, expended by way of advances or grants of a capital nature to the undertaking concerned.

Not more than three directors may be appointed to any Board. In any case the number appointed must be less than a majority of the board. Directors so appointed will be deemed to be appointed under the Articles of Association and will enjoy the same powers and responsibilities as directors elected by the shareholders. But they will be additional to the number of directors mentioned in the Articles and the company may keep its privately elected directors up to full strength. A person who is so appointed must be a person experienced in the direction of companies. He will hold office for one year and may then be re-appointed. He will not be entitled to a salary from the company, unless there is a special agreement.

Price Control

A competent authority has power to provide for maximum prices for goods and services which are required for the purposes of the Act. This is a new regulation which has been inserted. Wartime price control was exercised under the Goods and Services (Price Control) Acts. Section 2 of the Supplies and Services Act gave power to introduce regulations extending the wartime control to the peace time purposes of the latter Act. In addition to price control for a class of undertakings or a single undertaking, power is given to impose a licensing system. The same heavy penalties for breach of price control are imposed as for breach of the regulation dealing with control of industry. The only difference is that the sentence on conviction on indictment is limited

to seven years. It is also an offence to receive commission on a transaction which is a breach of the regulation. The onus is on the recipient of the commission to show that he did not know and had no reason to believe that the transaction or any part of it was an offence.

Avoidance of Strikes and Lock-outs

Regulation 58AA has attracted some attention during the past few months, because the employers have called it in aid in several disputes, notably the sensational London hotel strike. It is this regulation which gives force to the National Arbitration Tribunal and to the Order requiring employers and workers to resort to arbitration before a strike. It is at present the case, as during the war, that practically all strikes and lock-outs are illegal, unless 21 days' notice is given and the arbitration procedure is observed.

The regulation gives the Minister of Labour power to provide for the establishment of a tribunal for the settlement of trade disputes and to regulate the procedure of the tribunal. He may also prohibit strikes and lock-outs. Necessarily, he also has power to require employers to observe terms and conditions of employment not less favourable than the recognised terms and conditions, as determined by the tribunal, in case of dispute. There is a further power to record cases where departures have been made from the accepted terms.

Exemption from Factories Act

The Minister of Labour may for the purposes of the Act make Orders excepting particular premises or operations or classes of premises or operations or classes of machinery, plant or processes from the operation of the Factories Act 1937.

Explosives

Two new regulations have been inserted dealing with explosives. The Explosives Act 1875 exempts a government department from its provisions with regard to the carriage of explosives, where the regulations are complied with. It is now provided that this exemption may be extended to cover explosives, the conveyance of which is certified by a government department to be in connection with the execution of a contract with that department.

Orders Affecting Chemicals

The powers given under the Supplies and Services Act have been used to keep a number of Orders in effect which were issued during the war. Readers will be acquainted with the Industry (Records and Information) Order 1941, and the Containers and Packaging Order 1945, both of which are still effective.

The controls of individual substances have been considerably reduced. The Orders affecting chrome fluospar, lac, antimony, pyrethrum, and silicon had already been repealed in 1945. During 1946 the control has been lifted on nickel, cadmium, ramie, and mercury. The existing Orders affecting alkali, industrial ammonia, bichromates, agar, chlorates, casein, cobalt, dyestuffs, detonators, mica, magnesium, nitric acid, petrol, potash and toluene remain in effect without amendment.

NEW ORDERS ISSUED IN 1946

Sulphate of Ammonia.—A charge payable to the government on sulphate of ammonia was imposed in 1940. The duty of collecting this charge was transferred to the Board of Trade as from April 1, 1946.

Sulphuric Acid.—Similarly, there was a charge on sulphuric acid. This has been abolished in respect of any period beginning on or after April 1, 1946. But liability arising before that date still stands and the duty of collecting what is outstanding is transferred to the Board of Trade.

Sulphur.—A new Order revokes and consolidates the previous Control of Sulphur Orders. It lays down a new price schedule, which has the effect of reducing the price by 25s. per ton. The full price schedule can be obtained from H.M. Stationery Office, Kingsway, W.C.2 (Control of Sulphur Order, 1946, Statutory Rules and Orders No. 302).

Molasses and Industrial Alcohol.—A new Order has been issued increasing the maximum price for acetates. Apart from this the control remains unchanged. (Statutory Rules and Orders 1946 No. 955).

Damar and Gum Damar.—By a new Order these substances are released from the Control of Natural Resins Order. Apart from these, the control remains.

Copper, Lead and Zinc.—An Order has been issued consolidating the Control of Non-Ferrous Metals (Copper, Lead and Zinc) Orders. Two important changes are introduced. In the first place a licence is now required for the acquisition of the following types of lead:—

(a) unwrought antinomial lead of all grades.

(b) all other unwrought lead alloys containing not less than 97 per cent by weight of lead.

(c) all scrap of lead alloys containing not less than 10 per cent and not more than 75 per cent by weight of lead.

Secondly, maximum prices for copper, lead and zinc were increased. But this new schedule was rendered out of date by a further Order issued in June increasing these maximum prices still further. Copies of the price schedule are contained in the amending Order which may be ordered from H.M. Stationery Office by reference to Statutory Rules and Orders, 1946, No. 964.

Fuel and Power in France

Development of Lignite

MONSIEUR E. G. VOIRET, Director of the Municipal Laboratory at Lyons, suggests that France could solve all her fuel and power problems and provide other things as well by large scale rational development of her very extensive lignite resources. In recent issues of *Chimie et Industrie* he enlarges on this theme at some length and possibly in a somewhat optimistic vein. Nevertheless, the acute need for fuel in France and other countries is such that proposals which, in normal times, would be held unworkable, now merit serious consideration; and M. Voiret seems to present a plausible case—always provided the requisite plant is obtainable.

He includes not only lignite but other low-grade coals and, indeed, a certain proportion of good coal. None of the last should, of course, be used in the wasteful manner of the past but employed to the best advantage in coke, gas, and chemical works, so that no part of the coal is lost and nowhere is the atmosphere unnecessarily polluted. French lignite resources are probably by now fairly well known. They have been frequently described, and the main point emerging from the author's interesting and rather detailed account is the extraordinary extent to which hitherto they have been ignored and neglected. In some cases they are contiguous with iron ore and other minerals, such as bituminous schists. The latter could often be worked in conjunction with lignite, even in the same shaft or workings, and would yield from 6 to 10 per cent of fuel oil.

Sources of Supply

Some of the principal French lignite deposits are these:

(1) **Fuveau Basin,** containing more than 1,000,000 tons in an area of 25,000 hectares in three or four seams of 4-8 metres thick, of very good quality, without excessive moisture or ash content. Pre-war output 8-900,000 tons per annum.

(2) **Manosque or Basse-Durance Basin,** in several comparatively thin seams over an area of about 60,000 hectares, averaging 60-80,000 tons per hectare; interstratified with beds of bituminous limestone.

(3) **Bagnols-sur Cize,** an immense formation of more than 30,000 hectares in Ardèche and Vaucluse, in fairly thick seams, but with rather high moisture and ash content, somewhat similar to the German lignites. Here again there are interlayers of bituminous formations; but neither these nor the lignite have been much more than sampled.

(4) **Minervois Basin,** near the Montagne Noire to the north of Narbonne, extending over 20,000 hectares in several seams, as yet hardly touched.

(5) **Landes area,** containing several extensive lignite deposits, some comparatively new, between Dax and the south of the Gironde. Ash is said to be only about 5-6 per cent, with low sulphur content.

(6) **Paris area,** another large ligniferous district covering four or five departments where the lignite-bearing Tertiary strata are much in evidence. Total thickness of lignite seams in some parts, *e.g.*, Yonne valley, is up to 20 m.

Other districts are also described, from which it would seem that, apart from the Paris district, most of them are in the south and east. In addition to these, the author indicates several important coal beds in France only slightly, or not at all, developed.

The basic principles on which these resources should be worked in the national interest is the establishment of large central coking, gas and power stations *in situ*, for production of coke, gas, sulphur, tar, chemicals and fertilisers; and where possible other minerals such as bituminous schists, iron ore, etc., should be developed in conjunction with these other enterprises. Transport of any of these or of the coal and lignites in the raw state should be eliminated or reduced to a minimum, which could be best achieved by establishing thermo-electric or power stations on the sites of the lignite or coal deposits. Another of M. Voiret's ideas is that of distillation for production of sulphuruus gas yielding volatile products and liquid fuel together with coke. In the case of fuels of high ash content, either coal or lignite, these could be used in connection with cement manufacture in which the ash could be incorporated. In other cases the principal products might be sulphur or nitrogenous fertilisers.

The author cites the case of the Leuna works in Germany before the war, where some 60,000 tons of sulphur per annum were produced from lignite. If it be assumed that 50-60 million tons of lignite were utilised in these various ways *in situ*, all the national requirements in fuel, power, sulphur, and nitrogenous fertilisers, as well as other chemicals, could be met. As a corollary, it is suggested that since the gas produced would consist largely of hydrogen, of which the calorific value is low, this could be separated out where conditions are suitable and utilised for the many purposes for which hydrogen is now required.

SOUTH AFRICAN CHEMICAL NOTES

(From our Cape Town Correspondent)

A GROUP of chemists at the Johannesburg sewage disposal works at Cydna has been experimenting with the recovery of fat from sewage. The chemists estimate that if sufficient equipment is made available they will be able to produce more than 100,000 lb. of soap a year. This is the first time this experiment has been attempted in South Africa. It has been undertaken as the result of the research of the bio-chemist in charge of the laboratory division of the Johannesburg City Council. He is assisted by a staff of 11 chemists, one woman microbiologist, and two women technical assistants. Farmers may also soon benefit from the work of these chemists, as the Johannesburgh City Council has voted £10,000 for experiments in the sterilisation of sludge to produce a safe fertiliser.

The chemist in charge said that it was claimed that Johannesburg led the world in the utilisation of sludge gas. Last year the chemists at Cydna produced their first sample of methyl alcohol from sludge gas.

As a result of experiments carried out in Johannesburg a large firm has signed a 25-year contract with the city council to use 300,000 cu. ft. of sludge gas daily, from which half the amount of cyanide needed for the Rand gold mines will be produced.

Ochre for Paints

The war has dealt kindly with the ochre mines of the Riversdale district of the Cape. Their supplies to the paint and distemper factories of the world—particularly Britain—brought in £20,000 a year ten years ago. Now the figure is about £50,000. Possibly the market would have expanded still further if shipping difficulties had not hamstrung the industry for more than six years. Now the leeway is being made up, as the South African product meets with a strong demand in the face of competition from Spain. Spain's price is lower, but the South African product is held to be of superior quality. Two concerns are operating the five mines which produce the Union's supply, all of which are within an area about 12 miles by eight, near Albertinia. Much of the administration is carried on in Mossel Bay, and refining is done at Congella, Durban. Production was limited during the war, but, on the other hand, exploration was stepped up, and large deposits were traced—sufficient to meet all demands for another 25 years—and more are still being found. The industry which used to employ all white labour, now finds non-European workers more suitable.

Large deposits of china clay and kaolin are extracted, as well as supplies of Fuller's earth. Silica rock, which overburdens the ochre, finds its way mainly to the Rand, to be used for furnace bricks. The industry was pioneered by a Bristol firm, through whose activity extensive quarrying was started 16 years ago. The ochre is produced cheaply, for labour and transport charges are not high. It is easily quarried, and a high grade is maintained by hand picking.

Linseed Oil Shortage

The present shortage of paint in South Africa is likely to continue until February or March, when the first shipments of linseed oil from Argentina are expected to arrive in the Union, it was stated recently. The price of the Argentine oil will probably be high, and the price of paint may have to be increased. Hundreds of thousands of gallons of paint are needed not only for new buildings but for sprucing up buildings in preparation for the Royal visit. In the meantime, paint manufacturers are rationing their customers severely. The price of dehydrated castor oil, which is being imported in place of linseed, has risen to as high as 19s. 6d. a gallon. Its normal price is about 12s. 6d. The Union formerly bought most of its linseed oil from India. Now India is exporting to Britain all the oil she does not use herself.

The prospect of completely eliminating tsetse fly from the Union in the near future were reasonably good, said Dr. R. du Toit, of Onderstepoort, when he described the results so far achieved with the spraying of DDT in the Mkuzi Game Reserve in Northern Zululand. Some six weeks must elapse before the campaign, in which nine aircraft are being used to spread the DDT smoke, is completed. Dr. du Toit said the result so far had been an almost 100 per cent elimination of tsetse fly in the 40 sq. miles of fly-infested territory being sprayed. The degree of tsetse-fly infestation was measured by the weekly catch of the Harris fly-traps.

When the spraying began on August 7, the catch of the traps had averaged between 600 and 700 a week, but in a November week a catch of only 13 was recorded. The complete success of the campaign, however, depended upon its prolongation over a period of at least five months. This was because the pupae of the tsetse fly, lodged in the ground, were unaffected by DDT smoke. Repeated and regular spraying was necessary over a period sufficient to allow for the hatching of all pupae present at the time of the first application and for fresh deposits of larvae by flies which might have escaped previous applications. Only after the final spraying would it be known for certain whether the campaign had been so completely successful as to warrant its exten-

sion. Practical difficulties would be encountered in extending the campaign to other affected parts of the Union. For effective penetration of the bush the smoke had to be sprayed by aircraft flying at not more than 50 ft. In these circumstances only tsetse flies inhabiting low bush country could be reached, and it would be necessary to devise some other method to deal with parts of the country where high trees and dense undergrowth prevailed. One method suggested for treating such country was the use of DDT smoke generators appropriately dispersed on the ground.

Goodwill Trade Mission

One of the recommendations which the recent South African goodwill trade mission to the East and Central African territories intends to embody in its report is that the Union Government should endeavour to establish "a general additional export quota" in essential requirements of adjoining territories. The purpose of this quota will be to build up "token deliveries" in order to retain the commercial goodwill of those countries in Africa which, during the war, drew most of their chemical and other requirements from the Union.

International Exhibition

THE proposal to hold an international exhibition on a large-scale in London in the near future has attracted much support since it was recommended by a Government committee in December 1945. No international exhibition has been held in this country for seventy years. The Government, however, while it has not yet reached a decision, is becoming increasingly doubtful about the proposal.

Meanwhile, the Royal Society of Arts—which, as the Society of Arts, took the initiative in promoting the International Exhibition held in Hyde Park in 1851—has joined in advocating the promotion of another "and far greater exhibition in 1951 to mark the centenary."

In order that fuller consideration may be given to a question which the Society regards as "urgent and of great importance," the Society, therefore, has arranged a conference, to be held at its headquarters in John Adam Street, Adelphi, London, at 11 a.m. on February 6, to discuss whether such an exhibition should be held in Hyde Park in 1951. Should the conference approve, the Government and the London local authorities would be approached.

Invitations to the conference have been sent to 165 organisations, accompanied by a letter signed by the president of the Royal Society of Arts, Viscount Bennett, and by a memorandum recounting the steps already taken to advance the project.

Institution of Chemical Engineers

N.W. Branch Annual General Meeting

THE second annual general meeting of the North-Western Branch of the Institution of Chemical Engineers was held in Manchester on January 3. The members were welcomed in the conference room of the Town Hall by the Lord Mayor of Manchester, Alderman T. H. Adams, J.P.

The annual report showed that the branch is still flourishing and growing steadily in numbers and prestige. The branch started off with a membership of 300, but this figure has now risen to 406, made up of 81 members, 178 associate members, and 147 graduates and students. Enthusiastic support was given to meetings held during the year at the College of Technology, Manchester, while a visit was also paid to Lever Bros.' works at Port Sunlight in July. During the year the hon. secretary of the branch, Mr. Rees Jones, was elected a member of Council, and Messrs. C. H. Bowden, H. S. Pink, and W. S. Norman were elected to the Board of Examiners. Arrangements are being made to hold a three-day refresher course in chemical engineering in Manchester this year.

After the meeting Mr. C. E. Rowe read a paper on "A Plan for Process Development," which gave rise to much discussion.

A dinner and dance was held in the evening at the Midland Hotel. Mr. J. McKillip, chairman of the branch, received the members and guests (among whom was the Editor of THE CHEMICAL AGE) before dinner. A toast to the city and port of Manchester was proposed by Sir Ewart Smith.

Replying to this, the Lord Mayor of Manchester hinted that the Government may one day inquire into the possibilities of Nationalising the chemical industry.

Among those present at the dinner were Viscount Leverhulme, Dr. C. J. T. Cronshaw, Dr. F. C. Toy, and Mr. C. H. Cremer, president-nominee of the Institution of Chemical Engineers.

Clay Minerals Research

The first meeting of the Mineralogical Society's Clay Minerals group is to be held at the Geological Society's room, Burlington House, Piccadilly, on Friday, January 24. It will consist of two sessions, a morning session starting at 10 a.m., and an afternoon session starting at 1.50 p.m. The aim of the meeting is to present an overall picture of clay mineral work at the present time. Various papers will be read, and will be followed by a discussion. Dr. D. M. C. MacEwan of the Rothamsted Experimental Station, Harpenden, Herts., welcomes inquiries from those interested in this meeting.

Coal Allocations

New System for Industries

A NEW system of allocating coal to industry during the next six "critical" weeks has been announced.

As from January 20, smaller allocations will be made but these will be quantities such as, subject to unavoidable transport difficulties, firms can reasonably expect to receive. Hitherto, firms have often received only 50 per cent of their allocations. In the case of some firms, there will be small, in other cases considerable, reductions in their allocations; but it is to be understood that the reductions will be in the allocations, not necessarily in the actual amounts delivered.

Provision is made for special additional supplies to firms engaged on work of national importance, the priority of which is to be decided regionally.

Electricity power stations are to be given an absolute priority.

Million Tons More Coal

An increase of a million tons in coal output during the Christmas and New Year holiday weeks is recorded in the November review of the coal industry issued by the Ministry of Fuel and Power, which includes preliminary figures for December. Concurrently, however, consumption increased "alarmingly," electricity works alone in the Christmas week using 33 per cent more than in the corresponding period in 1945. Total output in 1946 of saleable deep mine and opencast coal is expected to be 189,300,000 tons (1945, 182,772,700 tons) and total consumption, home and export, 193,350,000 tons.

Output of Soda-Ash Falls

Following complaints of the inadequate fuel supplies to I.C.I. works, it is announced that 100 per cent coal supplies are to be restored. It was stated that, although the Wallerscote, Northwich Works of I.C.I. Alkali Division—which supplies most of the soda ash and caustic—was once more in production, the low output was affecting dependent industries. According to Mr. J. K. Batty, divisional secretary, the division had been producing less than 50 per cent of its normal output. The Allied Association of Bleachers, Dyers, Printers, and Finishers sent a telegram on January 7 to Mr. Shinwell, pointing out that 300 textile finishing firms are seriously handicapped by curtailment of soda ash.

Rising Wholesale Prices

Oils and Metals Lead

CHEMICALS and oils show by far the largest price increase in the table of commodity price indices for December according to the *Board of Trade Journal*. A price increase of 5.5 per cent is shown in this group by comparison with the November figure—9.9 per cent higher than in December, 1945, and 67.5 higher than in 1938. This appreciation is the result principally of an increase of £30 10s. per ton (63 per cent) on December 1 in the price of crude palm kernel oil and of £28 per ton (48 per cent) on December 8 in the price of refined groundnut oil—the first price changes since 1943. The index number for the group is now 158.6 as compared with 144.3 the previous year (1930 = 100).

The second largest rise in commodity prices was registered by non-ferrous metals: + 2.8 per cent in December and 90.1 per cent higher than in 1938. This represents the price increase of copper, zinc, and brass which came into effect on November 13 and was not included in the November index. Electrolytic copper, copper wire, and solid drawn copper tubes rose on the average by 6 per cent, 5 per cent, and 4 per cent, respectively. Zinc and brass also advanced about 4 per cent.

Obituary

DR. ARTHUR JACQUES, who has died at the age of 59, was superintendent of Chorley Royal Ordnance Factory, prior to which he was in charge of the explosives and chemical branch at Woolwich.

MR. W. F. BLAIR, Scottish sales representative of A. Boake Roberts and Co., Ltd., died in hospital in Lahore on December 28. Mr. Blair, who had been with the company since 1926, had travelled extensively on its behalf throughout the world, particularly in the Far East. Last year he undertook a further visit to India and was taken ill while in Lahore.

MR. ALEXANDER A. INGRAM, formerly assistant manager, with Ogston & Tennant, Ltd., soap manufacturers, Aberdeen, has died at his home there. He joined the firm in 1892 and became assistant manager in 1941, retiring more recently.

The Department of Agriculture estimates that the principal producing countries will export 2990 thousand short tons of fats, oils and oil seeds this year, compared with an average of 6511 thousand during the 1935-1939 period.

MANAGEMENT PROBLEMS

In order to assist subscribers in the solution of their management problems we invite questions relating to such matters as accounting, costing, control of plant and materials, office methods, income tax, etc. Correspondents will be answered under initials but should give their names and addresses which will not be published, and when documents of any kind are sent to us they should be copies only, as they cannot be returned. Letters should be addressed to the Editor.

Patent Law

Query.—" Could you advise me whether recommendations for patent law reform have been submitted, and if so whether such recommendations are available in book form?"—T.V.

Reply.—Part I of the memorandum of evidence prepared by the Joint Chemical Committee on Patents (consisting of representatives of the various chemical bodies interested) was submitted to the Board of Trade in September 1944, and Part II, covering wider aspects of patent law reform, was submitted in June 1946. Copies of the memorandum can be obtained from the Association of British Chemical Manufacturers.

Query.—" I have been requested by the Inspector of Taxes to furnish an income tax account, and I am enclosing a copy of my profit and loss account covering the past year's operations. Could you suggest how the adjustments, if any, should be made?"—D.O.

Reply.—The figure of net profits shown in the profit and loss account will not be accepted by the income tax authorities for the purpose of computing the balance of taxable profit under Schedule D, as certain items have been charged that are not allowed to stand as deductions. All normal expenses and business charges are allowed, but no items of the following nature can stand :—

(a) The cost of alterations, additions, extensions or improvements to the business premises.

(b) The cost of installing new or additional engines and boilers.

(c) Sums which have been written off the book value of any asset or section of plant to cover depreciation. Although obsolescence and decline of capital value constitute definite charges against profits, taxpayers are only granted wear and tear allowances intended to cover those parts of the assets which have actually been worn out in the process of earning profits to be taxed, and this allowance must be claimed.

(d) Private drawings, including the salaries of partners, interest on capital, and payments made to inactive partners.

(e) Expenses of a personal nature, or not directly connected with the business.

Stock Ledger Cards

Query.—" We purchase most of our material in bulk, it being unloaded in the open and then transferred to the stores located in the process building where it is weighed. The store bins are of equal size, and this enables the quantities on hand to be readily determined and at the same time affords a check on the accuracy of the foreman's reports, but we are anxious to adopt a stock ledger card system, mainly for costing purposes . . ."—S. & F.

Reply.—Stock ledger cards used in connection with bulk orders are usually divided into three sections, one for the individual orders, another for the outstanding orders, and the third for the stock, and pen-and-ink methods are being gradually reduced by the use of accounting machines. The order forms may be provided with columns for recording the pick-up, order number, the receipts, the balance of the order, and the date, in which case the individual orders section of the ledger card should be ruled accordingly in order that the particulars can be printed on both the statement and ledger card at one operation. Upon the receipt of material constituting part of an order, the item would appear in the receipts column of the order form and ledger cards, and would go into the balance of order column in the form of subtraction from the pick-up, and the outstanding orders section of the ledger card would then be balanced, as also would the stock section. When material is issued, only the stock section of the ledger card would be affected, and it is a simple matter to enter the items and extend the new balances.

Share Application and Allotment Entries

Query.—" As perhaps you are aware, we are increasing our capital by the issue of new preference shares. The application forms have been sent to our bankers, and when the lists come back we shall send out the letters of allotment and letters of regret, and we are wondering if it is possible for you to supply us with information regarding the customary method of entering up the amounts due on application and allotment in the books."—T.H.A.

Reply.—Details of the share capital should be kept in share books, the private

ledger containing accounts which summarise the share ledger entries. The amounts due on application and allotment are usually entered in a special book from which they can be posted to the shareholders' accounts, and the application entries are made in the following order: The first entry will represent the total of the amounts per share due on application for a definite number of specified shares of a certain amount each, this being credited to the share capital account and debited to the application account. The total cash received as application money is then posted from the debit side of the cash book to the credit side of the application account. The latter will have to be adjusted if the shares have been over-subscribed, otherwise the credit side would exceed the total of the debit side, and amounts representing cash paid in excess should be debited and posted to the credit side of the allotment account. The total sum returned to applicants with letters of regret should be posted from the cash book to the debit side of the application account. The total of the amounts per share due on allotment should be credited to the share capital account and debited to the allotment account, the cash received on allotment being then posted from the cash book to the credit of the allotment account. If the shares have still been oversubscribed, the allotment account will have to be adjusted by transferring the excess to the call account.

Quality Control

Query.—"Planning in chemical engineering covers a very wide field, and, of course, process planning demands a considerable degree of specialisation, and while a machine adjustment will sometimes rectify matters it seems to me that no amount of engineering effort can reduce random variations in quality, short of a complete change of process. As this is really a statistical problem, could you devote a little space to the subject of quality control in general?"—H.E.

Reply.—To be in a position to decide whether a particular part fails to reach a specified quality involves the taking of measurements in accordance with a definite plan. This emphasises the need for keeping process inspection records for the guidance of the control engineers, and as a distinction must be drawn between chance causes of variability—upon which no effort can have much influence—and variability due to the presence of controllable causes, there would have to be a segregation of types. Variability in such matters as tensile strength, resistance, hardness, etc., may be determined by reference to a basic standard, and the limits can be specified, so that by measurements on a series of pieceparts which have been produced under the same conditions the production engineer can decide what methods are justified to eliminate the causes of variation. A good charting system frequently brings improvements in quality and substantial reductions in costs, and during a process it is possible to maintain a record indicating the limits decided on the basis of prior data, and the average for each sample, with points charted to reveal the need for action. A simple form of chart would lay down the level to be aimed at, the upper and lower control limits, and the upper and lower engineering limits, and this should be sufficient to reveal any persistent upward or downward trend.

Machine Depreciation

Query.—"I am finding it difficult to decide the amount to be written off machines to cover depreciation, and should like to start keeping detailed equipment records. Would you help me in this matter, and indicate a simple pattern of record which would enable me to refer to the details of any particular machine?"—G.L.

Reply.—Machine records may consist of cards kept in a drawer, where they can easily be maintained in position by means of a steel rod or other similar device, and a detailed description of each unit may be set down at the top of the card, sufficient space being reserved for showing the cost of acquisition, transport charges, installation expenses, and the periodical valuations. The records may include such particulars as the location, a description of any attachments or devices, the maker's name and number, the size, weight, etc., and on the back of each card may be entered the amount of depreciation written off, and the cost of any additions or improvements.

U.K. Tin Position

Stocks Increase during November

A RISE in the stocks of tin ore in the United Kingdom during November is reported by the Ministry of Supply. Stocks at the end of the month totalled 9253 tons, as compared with 7727 tons on November 1 and 8052 tons at the beginning of October.

There was, however, a drop in stocks of tin metal held by the Ministry from 10,919 tons at the beginning of November to 8464 tons at the end of the month, while consumers' stocks on November 30 were calculated at 4090 tons and reported at 3603 tons, as against 4274 tons on the first of the month.

For the third successive month, no arrivals of tin were reported. Production during November amounted to 1897 tons.

Deliveries of tin to United Kingdom consumers totalled 2217 tons and, for export, 238 tons. Consumption of the metal by consumers amounted to 2401 tons.

NEXT WEEK'S EVENTS

TUESDAY, JANUARY 21

Institute of Welding (Eastern Counties Branch). Mr. R. G. Braithwaite: "Structural Welding Problems" and Bailey Bridge construction film.

Electrodepositors' Technical Society. Northampton Polytechnic, St. John Street, Clerkenwell, London, E.C.1, 5.30 p.m. Mr. G. E. Gardam: "Smoothing Action as a Mechanism in Bright Nickel Plating."

Society of Dyers and Colourists (Manchester Section). 6.30 p.m. Mr. G. S. Egerton: "Action of Light on Dyed Textiles."

Society of Chemical Industry (Agricultural Group). Royal College of Science, London, S.W.7, 2.30 p.m. Dr. F. H. Malpress: "Use of Hormones in Animal Husbandry."

Institute of Physics (Scottish Branch). The University, Edinburgh. Prof. P. I. Dee: "Photography of Atomic Tracks."

Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Mr. W. F. Archibald: "Calcium Carbide Manufacture."

WEDNESDAY, JANUARY 22

Association of Tar Distillers. Leeds, 2.30 p.m., A.D.T. general meeting.

Society of Dyers and Colourists (Midlands Section). Victoria Hotel, Nottingham, 7 p.m. Mr. C. S. Turner: "Shortcomings of Dyeing Industry in Relation to Laundries, etc."

British Association of Chemists (Birmingham Section). Chamber of Commerce, Birmingham, 7 p.m. Mr. R. E. Essery: "Industrial Fermentations."

THURSDAY, JANUARY 23

Association of Tar Distillers. Leeds, 9 a.m., B.R.T.A. Finance Committee; 10 a.m., B.R.T.A. Managing Council.

Chemical Society. Liverpool University, Chemistry Lecture Theatre, 5 p.m. Prof. H. A. Krebs: "Metabolic Cycles." University College Swansea, 6 p.m. Mr. E. J. Bowen: "Absorption of Light."

Institute of Chemistry (Bristol and S.W. Counties Section). Bristol University, 5.30 p.m. Dr. T. Malkin: "Review of X-ray Work on Long Chain Compounds." Manchester and District Section: Engineers' Club, 17 Albert Square, Manchester, 7 p.m. Prof. T. P. Hilditch: "Fat Shortages and Fat Substitutes."

Mineralogical Society. Geological Society of London, Burlington House, Piccadilly, London, W.1, 5 p.m. General meeting.

Society of Chemical Industry (Edinburgh and East of Scotland Section). Mr. F. A. Scholefield: "Edmund Knecht" (Jubilee Memorial Lecture).

FRIDAY, JANUARY 24

Institute of Fuel (Scottish Section). Royal Technical College, Glasgow, 5.45 p.m. Mr. H. Bannister: "Determination of Dryness Fraction of Steam and Disadvantages of Wet Steam."

Chemical Society. Marischal College, Aberdeen, 7.30 p.m. Dr. D. P. Cuthbertson: "Metabolism of Proteins and Amino Acids."

"Britain Can Make It"

Further Exhibition Envisaged

THE "Britain Can Make It" exhibition, during its 14 weeks' duration at the Victoria and Albert Museum, London, S.W., proved a success. This was made clear at a Press conference held by the promoters, The Council of Industrial Design, in London last week. Would-be exhibitors were 1000 more than were represented at the last B.I.F. Although the purpose of the exhibition was to foster and publicise good design in the various industries from which the 5259 exhibits were chosen, not primarily to promote new business, the volume of business offered by overseas trade visitors reached embarrassing proportions and many undertakings not exhibiting benefited from the surplus of the orders directed from the exhibition to the appropriate industries. Of the total of 1,432,369 persons who passed through the turnstiles, 43,300 were known to have been commercial buyers, and there must have been several thousand more of whom there was no record; and 7106 trade buyers from overseas contacted the Council's Trade Inquiry Section. They came from 67 countries and more than 25 per cent of them from Empire countries. Unofficial estimates of the volume of orders vary from £25 million to £50 million. "It is impossible to give any reliable estimate of the real figure," say the organisers.

The Council announced its intention of organising further "Britain Can Make It" exhibitions and in the meanwhile will arrange, in co-operation with the Federation of British Industries, local "Design Weeks" in Provincial centres, serving on a small scale the same objects as the London exhibition.

Personal Notes

SIR EDWIN NOEL PLOWDEN has been appointed a director of British Aluminium Co., Ltd.

MR. FORREST HEWIT has been re-elected chairman of the Chemical and Allied Trades Section of Manchester Chamber of Commerce.

MR. JOHN R. DOUGLAS has retired from the service of T. & H. Smith, Ltd., of Edinburgh, chemical manufacturers, after 44 years' service.

MR. H. HAWORTH, formerly the firm's representative for south-east Lancashire, has taken over the position of chief buyer with Vitax Fertilisers, Burscough Bridge, Ormskirk.

MR. F. W. OSBORN has become manager of the Midland branch of the British Aluminium Co., Ltd., in place of Mr. C. G. Pountney, who resigned from the staff last month.

SIR FREDERICK BAIN, M.C., who has been nominated president of the Federation of British Industries, to succeed the retiring

Sir Frederick Bain, M.C.

president, Sir Clive Baillieu, K.B.E., C.M.G., is deputy chairman of the Association of British Chemical Manufacturers. He was appointed deputy-president of the F.B.I. last February. Deputy chairman of Imperial Chemical Industries, Ltd., Sir Frederick was, during the war, chairman of the Chemical Control Board, Ministry of Supply and also chairman of the Chemical Planning Committee of the Ministry of Production. During the 1914-18 war he saw active service as captain in the Gordon Highlanders, gaining the Military Cross; and later, he became deputy-director of Chemical Warfare Supply at the Ministry of Munitions. A knighthood was conferred upon Sir Frederick in the New Year Honours list of 1945, following his work as chairman of the Chemical Control Board.

MR. C. A. MASTERMAN, M.A., F.R.I.C., M.Inst.Mech.E., M.Inst.Gas E., M.Inst.H. and V.E., has resigned as chief technical officer to the Gas Light & Coke Co.

On his retirement from the chairmanship of the British Gas Council, MR. A. E. SYLVESTER has been elected president. COLONEL H. C. SMITH succeeds him as chairman of the executive board.

SIR ALFRED EGERTON, M.A., B.Sc., F.R.I.C., F.R.S., Professor of Chemical Technology at the Imperial College of Science and secretary of the Royal Society, is in hospital in Switzerland following an accident.

MR. W. C. F. HESSENBERG, chief officer of the Liaison Department of the British Non-Ferrous Metals Research Association, has been appointed chief of the Mechanical Working Division of the British Iron and Steel Research Association.

DR. H. H. HODGSON, of Huddersfield Technical College, has been awarded the Gold Medal of the Society of Dyers and Colorists for outstanding services to the Society and for contributions to organic chemistry in relation to the dyestuffs industry.

MR. DONALD HICKS, M.Sc., F.R.I.C., an associate member of the Institute of Chemical Engineers, and member of the Institute of Fuel, has been appointed by the National Coal Board as Director of Scientific Control under the scientific member. Mr. Hicks has been with the Department of Scientific and Industrial Research since 1924.

MR. E. C. QUILL, a director of Kemball, Bishop and Co., Ltd., Crown Chemical Works, London, E.3, which he joined as a junior forty-five years ago, has retired owing to ill-health. He was elected to the board in 1941. MR. W. W. MUIR, for many years secretary to the company, now vacates that position, on being elected a director and fulfilling the office of commercial manager.

DR. C. A. THOMAS, whose election as president of the American Chemical Society was recently announced, is a vice-president and technical director of Monsanto Chemical Co., the American associate company of Monsanto Chemicals, Ltd. One of the principal scientists concerned in the development of atomic energy and the atomic bomb, Dr. Thomas had charge of the final purification and metallurgy of plutonium—the 94th element—produced at the Tennessee laboratories of the Monsanto Co. Among his earlier achievements was research resulting in production of tetra-ethyl lead. He was one of five co-authors of "A Report on the International Control of Atomic Energy," while his "Anhydrous Aluminium Chloride in Organic Chemistry" has become a standard work.

Home News Items

The Transatlantic radio-telephone service, inaugurated in January, 1927, celebrated its twentieth "birthday" last week. To-day, 32 countries can be reached by radio-telephony from Great Britain.

A new gasholder for the Newcastle and Gateshead Gas Company which has taken two years to build, is expected to be completed shortly. Costing £115,000, it will increase the company's storage capacity by 3,000,000 cu. ft.

A visit to the works of the Dunlop Rubber Co., Ltd., at Fort Dunlop was paid by a party of students, attending a vacation course in Birmingham, from Brazil, British West Africa, British West Indies, Ceylon, Cyprus, Egypt, Finland, Holland, India, Iran, Italy, Luxembourg, Sudan and Transjordan. The course was arranged by the British Council.

That 750,000 tons of coal would be saved annually if all the power now produced in Lancashire's cotton mills by steam engines were provided by electrical power from public supply was the claim of Mr. W. E. Swale, M.I.E.E., Assoc.M.Inst.C.E., when, on behalf of the British Electrical Development Association, he addressed the Lancashire Section of the Textile Institute in Manchester. His subject was "Public Electricity Supply and the Textile Industry."

One English oil well—at Eakring, Nottinghamshire—is capable of yielding 12 tons of oil a day. This is revealed in a review by Mr. P. L. Rumsby in the bulletin of the Imperial Institute in which he records that English production since 1938 totals about 440,000 tons of good quality oil, of which 430,000 tons came from the Nottinghamshire area where there are six oilfields. Two more are in Lancashire and Scotland. Good coal deposits have been found in the process of boring.

First fruits of the initial year's work by B.E.T.R.O. (British Export Trade Research Association) show that some 600 overseas inquiries and research projects were successfully carried out, among them an investigation for Messrs. Reckitt and Colman (Overseas), Ltd., into prospects for disinfectants in France, which, said a director of Messrs. Reckitt and Colman, "showed special opportunities of which they hoped to take full advantage in their marketing plans." The Association of British Chemical Manufacturers have recently become affiliated members of B.E.T.R.O.

Three employees of Plasticraft, Ltd., Jubilee Close, Townsend Lane, Kingsbury, London, N.W.9, were reinstated with effect from December 31, 1946, as a result of an appeal to the National Arbitration Tribunal.

A six-day week in place of the present seven-day week for shale oil process workers has been suggested by Scottish Oils, Ltd., and endorsed by the Executive Committee of the National Union of Shale Miners and Oilworkers. This suggestion has been approved by all but two of the branches. The new week will probably come into operation shortly.

An increase of rather more than 7 per cent in the price of tungsten ore of standard grade, from 70s. to 75s. per unit of WO_3 delivered, is announced by the Ministry of Supply. Price of special high-grade scheelite (WO_3 minimum 68 per cent, tin molybdenum maximum 0.10 per cent) is now 80s. per unit WO_3 delivered. The new prices became effective on January 1.

A bomb one thousand times as effective as that dropped on Nagasaki could be made if science could develop a method of using hydrogen instead of uranium for atomic energy. So stated Professor M. L. E. Oliphant, of Birmingham University, speaking in Australia. He revealed that scientific research was now progressing towards the combination of hydrogen with helium to create a heavier substance. If successful, he said, this would enable "deadlier" atomic weapons to be created.

For factory sports officers a one-week course is to take place from March 22-29 at the national recreation centre of the Central Council of Physical Recreation, Bisham Abbey, Berkshire, the purpose being to provide guidance in up-to-date methods of organising physical recreation in factories. The inclusive cost will be £5, and firms are invited to send suitable men. Inquiries should be made to the Organising Secretary, C.C.P.R., 6 Bedford Square, London, W.C.1.

The future of German industry has been under discussion between Mr. Ernest Bevin and Mr. J. B. Hynd, Minister in Charge of Administration in the British zone, including the proposed nationalisation of the main industries. The Government is expected shortly to announce plans to prevent the formation of cartels; one measure will probably be an order, similar to that already announced by the United States Government, prohibiting any German firm from employing more than 10,000 workers.

Overseas News Items

The international accord on German-owned patents has now been accepted by 25 countries, in addition to Great Britain.

A pilot plant for the production of Gammexane (666) has been established in the U.S.A. by E. I. du Pont de Nemours & Co.

Denmark is to receive pig-iron, chemicals, common salt and glass from Holland under a supplementary trade agreement signed in Copenhagen at the end of December, 1946.

Thuringia has resumed the export of industrial and medical glassware and of pharmaceutical products, considerable quantities of which have recently been sent to Switzerland in return for consumer goods.

Oils of all kinds were by far the largest of British India's imports in the 12 months ended March 31, 1946, valued £60 million, as in the previous 12 months. The value of imports of chemicals, drugs and medicines was also unchanged at £8 million.

For construction of a penicillin plant in Rome, a credit of 350,000,000 lire has been authorised by the Italian Government. The machinery is to be provided by U.N.R.R.A., and the drug will be marketed through the private trade.

The most modern petroleum driller to go to South America has been purchased in the U.S.A. by the Argentine State Oilfields. It is a three-motored, six-cylinder Diesel engine of 1680 h.p. and cost about £150,000. It is claimed to be capable of drilling more than 10,000 ft.

The recent Italian trade mission to London is to be followed up by a further visit from its leader, Signor Mascia, states a Rome report. The purpose of this further visit is understood to be the signing of a trade agreement and the setting up of a permanent Anglo-Italian trade committee.

Renewed activity is reported in Newfoundland's metallic ore and concentrates industries and shipments of iron ore from the Bell Island mines are moving to the U.K. regularly. Production figures for the nine months to September, 1946, were: iron ore, 931,000 tons (968,000 in the whole of 1945), of which the U.K. took 487,000 tons; copper concentrates, 12,100 tons; lead concentrates, 28,000 tons; zinc concentrates, 70,000 tons. All were slightly less than the 1945 figures. Fluospar from one plant in the same nine-months period totalled 12,000 tons, against 20,000 tons in the 1945 period.

Under a new Polish-Norwegian trade agreement, Poland will export coal, coke, zinc-ore and chemicals.

In Belgium, the shortage of soda threatens the closing down of several glass ovens; exports have been curtailed and shipments go only to Holland and the Belgian Congo.

The Argentine Government is reported to plan increasing the price of quebracho to about 8 cents a pound and setting export quotas for each importing country.

Steel output in the United States in 1946 was 17 per cent below that of 1945. According to the American Iron and Steel Institute, the mills produced 66,364,000 tons last year, as against 79,702,000 tons the previous year.

In Bihar Province, which is believed to contain about 80 per cent of India's mineral wealth, iron and steel plants and shellac factories are to be established under a five-year plan.

In Sweden, a new company has recently been established to produce and sell chemical apparatus. It is a joint venture of the A/B Uddeholm and the A/B Svenska Metallverken in co-operation with Danish experts. Operations are to begin shortly.

Switzerland's exports of chemical and pharmaceutical products totalled 38.5 million francs in November, a decline by 1.1 million francs since October. While exports of pharmaceutical goods and aromatics declined, exports of industrial chemicals and dyes showed increases.

Output of penicillin in the United States during October reached 2,700,000,000,000 Oxford units, as compared with 675,000,000,000 units in October, 1945, and 230,000,000,000 units in October, 1944. This striking increase is largely attributed to the introduction of a new mould strain in the production process and to expanded production facilities.

Good prospects of expansion of British exports to Northern Algeria are indicated in a survey by H.M. Vice-Consul in Algiers (*Board of Trade Journal*, January 11), which notes that France, normally the source of most Algerian imports, which are now generally free from customs tariff, cannot adequately supply Algerian needs. Products which Algeria sought principally from Great Britain and Empire countries in 1946 included chemicals of all kinds, ferrotitanium, naphthalene, benzene, toluene and xylol.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION, London, N.W. (M., 18/1/47.) December 12, nine land registry charges, to Midland Bank Ltd., each securing all moneys due or to become due to the Bank; respectively charged on 14, 16, 18 and 20 Euston Buildings, 1 to 6 Regnart Buildings, Euston Street, 81, 83, 87 and 89, 91, 93, 95, 97, 101 and 103 and land and buildings and back of 93 to 103, all Euston Street, and 22 Euston Buildings, George Street, N.W. *Nil. July 1, 1946.

LANGLEY ALLOYS, LTD. (Bucks.), metal smelters, etc. (M., 18/1/47.) December 5. £25,000 third debenture to Pearl Assurance Co., Ltd.; general charge (subject, etc.). *£6,000 (Bankers) and £100,000. November 30, 1945.

Satisfactions

JOHN PRENTICE (LONDON), LTD., manufacturers of chemical products. (M.S., 18/1/47.) Satisfaction December 17 of debentures registered March 7, 1945, to the extent of £200.

PLASTILUME PRODUCTS, LTD., High Wycombe, acetate moulding manufacturers. (M.S., 18/1/47.) Satisfactions December 18 of debentures registered March 1, 1940, and July 12, 1941.

Company News

The nominal capital of **Cabas Chemical Co. Ltd.**, Church Hall, Main Road, Little Clacton, Essex, has been increased beyond the registered capital of £100 by £900 in £1 ordinary shares.

The nominal capital of **British General Manufacturing Co., (1941), Ltd.**, chemical manufacturers, etc., 14/18 High Holborn, London, W.C.1, has been increased beyond the registered capital of £750 by £4250 in £1 ordinary shares.

Birmid Industries, Ltd., states the chairman, Mr. C. C. Maundslay, in the annual statement, is negotiating with the Government for the acquisition of war-time plant and buildings to meet demands for increased output, " which are now and are likely to continue far in excess of pre-war levels, both in volume and value."

New Companies Registered

Harcourt Chemical Co., Ltd. (426,273).—Private company. Capital £2000 in 2000 shares of £1 each. Manufacturers of and dealers in chemicals, detergents, etc. Directors: W. Toomey; D. Toomey. Registered office: 2a, Shaftesbury Parade, Harrow.

Dead Cert Trap Co., Ltd. (427,240).—Private company. Capital: £4000 in 4000 shares of £1 each. Pest exterminators, manufacturing chemists, etc. Directors: H. Altham; W. Hobson. Registered office: 38 Borras Road, Wrexham.

British Solvates, Ltd. (427,133).—Private company. Capital: £1000 in £1 shares. Manufacturers of and dealers in chemicals, etc. Subscribers: E. Shamesh; L. Grahame. Registered office: 46a Finsbury Square, London, E.C.2.

M. H. Lowe, Ltd. (426,923).—Private company. Capital: £10,000 in £1 shares. Importers and exporters of chemicals, paints, plastics, etc. Subscribers: F. Lowe; G. Lowe. Registered office: 31-2 Union Street, Wednesbury.

Layton Chemicals, Ltd. (426,498).—Private company. Capital £2000 in 2000 shares of £1 each. Manufacturers of and dealers in chemicals, deodorisers, etc. Directors: C. Layton; Mrs. C. Layton. Registered office: 11, Argyll Street, London, W.1.

Dr. Phillips Research Corporation, Ltd. (425,474).—Private company. Capital £100 in 100 shares of £1 each. Research chemists, chemical manufacturers, etc. Directors: M. Phillips, E. Dopson. Registered office: 1, Angel Court, Throgmorton Street, London, E.C.2.

Fine Dyestuffs and Chemicals, Ltd. (426,983).—Private company. Capital: £50,000 in 50,000 shares of £1 each. To acquire all or part of the business of dyestuffs and chemical merchants carried on as " Fine Dyestuffs and Chemicals Co." Subscribers: R. Gillan; H. Newton; A. Phillips; E. Walters. Solicitors: Skelton and Co., 90 Deansgate, Manchester, 3.

Cosmocord Plastics, Ltd. (426,829).—Private company. Capital: £30,000 in 25,000 5 per cent participating preference shares of £1 and 100,000 ordinary shares of 1s. each. Moulders; manufacturers of and dealers in articles capable of being moulded from chemical or other substances, chemicals, etc. Subscribers: A. Schumann; R. Stuom. Solicitors: Wordsworth & Co., 39 Lombard Street, London, E.C.3.

Chemical and Allied Stocks and Shares

ALTHOUGH it can hardly be said that the labour troubles slowed down business in stock markets, British Funds eased fractionally earlier in the week, and demand for industrials appeared to be more selective. Criticism of the compensation terms in respect of electric supply shares was widespread in view of the loss of income involved, and was based on the same grounds as in the case of the railways. In fact, so far as the compensation clauses are concerned the Government appears to have taken the Transport Bill as a model. Selling of electric supply shares for reinvestment in securities offering a higher yield than Government stock has stimulated demand fr leading industrials, which in many cases recorded fresh gains. Iron and steels were steady and virtually unaffected by the threat of nationalisation " before the next General Election."

Chemical and kindred shares reflected the upward trend in industrials, Imperial Chemical being 46s. 1½d., B. Laporte marked 103s. 9d., Turner & Newall rose further to 94s. 6d., and colliery shares were again favoured on break-up value estimates. Among the latter, Staveley rose further to 56s., Shipley to 45s. 6d., and Bolsover to 68s. 6d., the last-named on higher dividend hopes. Buying, which lifted prices sharply, was followed by selling of German Potash bonds on the official statement that negotiations are not in relation to current potash sales, which it is disclosed, are not being made available for the service of the bonds.

Although the market is continuing to talk of a higher dividend for the past year, Borax Consolidated deferred eased to 48s. 9d., and elsewhere British Aluminium lost ground at 45s. 3d. Fisons were 66s. 9d., General Refractories good at 24s. 6d., and Nairn & Greenwich advanced to 88s. 9d. on the higher profits and the centenary bonus accompanying the unchanged dividend. A feature has been an advance from £8⅜ to £17¼ in Joseph Nathan on the scheme whereby Joseph Nathan will be absorbed by its subsidiary, Glaxo Laboratories, the latter purchasing Nathan's assets and shareholders receiving similar shareholding in Glaxo Laboratories.

Guest Keen strengthened to 49s. and Stewarts & Lloyds advanced to 60s. 3d., the latter on the oil pipeline projects in the Middle East which will involve big demand for steel pipes. United Steel, however, have now eased to 27s. 3d. on the £2,000,000 preference share issue, but Dorman Long 28s. and Colvilles 26s. showed steadiness. Firth Brown strengthened to 51s. 3d. with the new 4 per cent preference shares of Firth Brown Tools at 1s. premium over the issue price of 21s. Dealings up to 60s. 3d. were shown in Morgan Crucible "A" ordinary, Greeff-Chemicals Holdings 5s. ordinary were 13s. 9d. and Monsanto Chemicals 5½ per cent preference marked 23s. 3d. British Drug Houses at 64s. 9d., however, have reflected profit-taking, but paint shares were wanted, Lewis Berger rising further to £8⅝, International Paint to £7⅞ and Pinchin Johnson 10s. ordinary to 52s. 9d.

In other directions, Imperial Smelting rallied to 21s. 6d., but De La Rue were marked back to £14, awaiting further news of the important developments foreshadowed in connection with the plastics side of the business. British Xylonite have been more active up to £7⅝, and British Industrial Plastics 2s. shares were 8s. 4½d. Boots Drug were 65s. 9d. and Distillers firmed up to 140s., while Sangers strengthened to 36s. 6d. Beechams deferred were 28s. 6d. and Griffiths Hughes 62s. 6d.

Oils remained more active, although Anglo-Iranian at £6⅜ failed to hold all their further advance. Apex (Trinidad), however, made good headway at 42s. 7½d. and Attock rallied to 51s. 3d.

British Chemical Prices

Market Reports

A SUSTAINED demand both for home and export account has been reported from the general chemicals market, with all sections displaying a strong undertone. A number of price changes have already been notified and further items are likely to see price-revision in the near future. The supply position, already difficult, has been further aggravated by reductions in output due to coal shortage, and the harmful results of this situation are likely to be felt for some time, even should the fuel position show an early improvement. There have been outstanding features on the coal-tar products market, and a quietly steady trade is being put through for any available items. Prices are firm.

MANCHESTER.—The supply position of soda ash and certain other alkali products continues to be affected by the cut in production by makers in the Lancashire area, as a result of the fuel shortage, and there is no sign as yet of an early return to the former level of output. Textile and other users are seriously concerned regarding the position, which, if it continues for long, will inevitably affect their own operations. There has been a steady flow of home and export inquiries for all descriptions of heavy chemicals on the Manchester market during the past week and prices are firm in all directions, with the recent advances in non-ferrous metal compounds and certain other products well maintained.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification

Applications for Patents

Separation of gases.—A. A. Aicher. 35801.

Fusion of iron with carbon.—Brown, Boveri, & Cie, A.G. 35804.

Thermal power plants.—Brown, Boveri, & Cie, A.G. 35805.

Hydrocarbon oil refining.—Separator-Nobel, A/B. 35913.

Distillation process.—Aluminium Plant & Vessel Co., Ltd., and D. G. Randall. 36002.

Catalysts.—J. C. Arnold. (Standard Oil Development Co.) 36213.

Handling of particulate materials.—M. H. M. Arnold, R. J. Young, and I.C.I., Ltd. 35881.

Treatment of supply water.—S. G. Barrett, and N. A. F. Rowntree. 35794.

Production of ozone.—S. G. Barrett, and N. A. F. Rowntree. 35795.

Acetate filaments.—T. F. Barrington. 36239.

Coating compositions.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. 36204.

Extraction of vitamins from marine animals.—K. Berner. 36083.

Ethers.—British Drug Houses, Ltd., W. Bradley, and O. Stephenson. 36117, 36208, 36209.

Fertilisers.—H. de. Bruijn, M. H. R. J. Plusjé, and Directie van de Staatsmijnen. 36068.

Metallisation of polythene.—Callender-Suchy Developments, Ltd., and C. T. Suchy. 36145.

Azo-dyestuffs.—Ciba, Ltd. 36003-4.

Dyestuffs.—S. Coffey, D. A. W. Fairweather, F. H. Slinger, and I.C.I., Ltd. 35878.

Liquid atomising means.—E. G. Cribb. 36321.

Silica gels.—Davison Chemical Corporation. 36375.

Difluoroethene.—E.I. Du Pont de Nemours & Co. 36148-9.

Catalysts.—E.I. Du Pont de Nemours & Co. 36150.

Treatment of dehydrated leafy vegetation.—C. E. Every. (W. R. Graham, G. O. Kohler, and C. G. Blauw.) 36039.

Rubber stabilising.—Firestone Tyre & Rubber Co. 36298.

Plastic mouldings.—C. F. Forsdick, and Hawley Products, Ltd. 36069.

Synthetic resins.—F. W. Hay. 36053.

Gas carburising.—F. W. Haywood, and Wild-Barfield Electric Furnaces, Ltd. 36206.

Atomisers.—G. W. Higgs. 36138.

Treatment of metals.—High Duty Alloys, Ltd., and L. Whitby. 35766.

Staple yarn.—F. Hill, D. Traill, and I.C.I., Ltd. 36151.

Moulding compositions.—Hornflowa, Ltd., R. Neiger, and L. Weiss. 36367.

Oxygen.—Hydrocarbon Research, Inc. 35752-6.

Vinyl fluoride.—I.C.I., Ltd. 36147.

Moulding compositions.—W. D. Jones, V. E. Yarsley, D. F. Mordant, and F. W. Berk & Co., Ltd. 36380.

Metallic castings.—W. D. Jones, V. E. Yarsley, D. F. Mordant, and F. W. Berk & Co., Ltd. 36381.

Treatment of thermoplastic materials.—Kasy A/B. 36036-7.

Plastic moulding processes.—L.L.H. Co. 36190-1.

Metallic coatings.—K. Loris, and F. Novotny. 35821.

Coating compositions.—A. McDonald. 35927-8.

Purification of naphthalene.—Midland Tar Distillers, Ltd., R. Scott, and E. H. Joscelyne. 36043.

Solvent extraction apparatus.—Midland Tar Distillers, Ltd., R. Scott, and E. H. Joscelyn. 36044.

Cementation of metallic articles.—J. C. Mills. 36243.

Treatment of mica.—Mycalex Corporation of America. 36385.

Anion exchange resins.—J. R. Myles, W. J. Levy, and I.C.I., Ltd. 35877.

Cyclohexane manufacture.—N.V. de Bataafsche Petroleum Maatschappij. 36075.

Ferrous alloys.—Nitralloy Corporation. 35828.

Fertilisers.—Office National Industriel de l'Azote. 36109.

Insecticides.—Pal Chemicals, Ltd., and F. E. Smith. 36377.

Heat treatment of metals.—O. Prosperi. 35995.

Phosphorus compounds.—Roche Products, Ltd., A. R. Todd, and F. R. Atherton. 35844.

Polymerisable compositions.—A. H. Stevens. (American Cyanamid Co.) 36299.

Application of metallic powders.—Strachan & Henshaw, Ltd., and C. D. Newman. 36342.

Drawing of fibrous material.—J. M. Termens. 35942-3.

Abrasive articles.—W. W. Triggs. (Carborundum Co.) 36360.

Nitrogen compounds.—W. Tyerman, and I.C.I., Ltd. 35880.

Fertilisers.—W. Tyerman, R. G. Franklin, R. Parmelia, A. H. Lewis, and I.C.I., Ltd. 35884.

Separation of vapours, etc.—W. Tyerman, F. Wrigley, and I.C.I., Ltd. 35879.

Catalysts.—Ustav Pro Vedecky Vyzkum Uhli, B. Simek, and J. Ludmila. 36050.

Substituted allylamines.—Wellcome Foundation, Ltd., and D. W. Adamson. 36257-8.

Dyestuffs.—D. G. Wilkinson, and I.C.I., Ltd. 35882-3.

Complete Specifications Open to Public Inspection

Production of heterocyclic substituted phenacylpyridines.—American Cyanamid Co. June 9, 1945. 17067/46.

Impregnating compositions.—Bakelite Corporation. June 8, 1945. 17007/46.

Catalysts of fuels and the treatment of hydrocarbons.—D. Balachowsky. June 23, 1939. 34369/46.

Permanent mechanical finishes on cellulosic fibrous materials.—J. Bancroft & Sons, Co. June 5, 1945. 10743/46.

Synthetic rubber base wrinkle composition.—N. T. Beynon. June 9, 1945. 3627/46.

Resin emulsion base wrinkle composition.—N. T. Beynon. June 9, 1945. 3629/46.

Production of smoke, fog or vapour clouds.—C. A. Bonvillian, R. C. Brierly, and S. Letvin. June 26, 1943. 12147/44.

Imidazolines.—Ciba, Ltd. June 6, 1945. 16196-7-8-9/46.

Manufacture of organo siloxanes.—Corning Glass Works. Dec. 12, 1944 18310/45.

Production of copper sulphate.—N. Corsini. June 8, 1945. 33263-4/46.

Preparation of colloidal dispersions.—A. A. A. Darche. April 26, 1945. 24393/46.

Apparatus for electrically treating fluids.—Dubilier Condenser Co. (1925), Ltd. June 5, 1945. 3768/46.

Production of organic fluorine compounds.—E.I. Du Pont de Nemours & Co. April 23, 1943. 7549-50-1-2-3/44.

Production of *N*-substituted fluoroacetamides.—E.I. Du Pont de Nemours & Co. April 23, 1943. 7554/44.

Polymers of vinylidene fluoride.—E.I. Du Pont de Nemours & Co. April 20, 1944. 9936/45.

Synthesis of organic oxygen containing compounds.—E.I. Du Pont de Nemours & Co. June 7, 1945. 17069/46.

Synthesis of aldehydes and other organic oxygen-containing compounds.—E.I. Du Pont de Nemours & Co. June 7, 1945. 17070/46.

Insecticides and their methods of application.—Electrolux, Ltd. June 7, 1945. 17062/46.

Manufacture of polymers containing oxygen.—I.C.I., Ltd. July 4, 1942. 10757-8/43.

Polymeric materials.—I.C.I., Ltd. Oct. 26, 1942. 2069/44.

Alkyd resins.—I.C.I., Ltd. July 28, 1943. 14436/44.

Carbonisation of coal.—Institute of Gas Technology. June 7, 1945. 9293/46.

Polymerisation.—International Polaroid Corporation. Feb. 12, 1944. 24446/44.

Adding one or more alloying components to a steel or iron bath.—G. N. Kirsebom. June 9, 1945. 24995-6/45.

Resin base uncooked wrinkle composition.—E. Lorenzo-Luaces. June 9, 1945. 3628/46.

Rubber base uncooked wrinkle composition.—E. Lorenzo-Luaces. June 9, 1945. 3630/46.

Production of carbon black.—Phillips Petroleum Co. Dec. 14, 1942. 34226-7/46.

Preparation of intermediates for the synthesis of heterocyclic compounds.—C. C. Price, and R. H. Reitsema. June 4, 1945. 20218/46.

Preparation of heterocyclic compounds.—C. C. Price, R. M. Roberts, and H. F. Herbrandson. June 4, 1945. 17135/46.

Process and installation for the combined manufacture of nitric acid and sulphuric acid, more especially for highly concentrated acid.—F. J. Salsas, and M. J. L. Delplace. June 4, 1945. 20070/46.

Preparation of nuclear substituted heterocyclic compounds.—H. R. Snyder, and R. E. Jones. June 4, 1945. 20219-20/46.

Manufacture of multicellular glass.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey. March 5, 1945. 23015/46.

Conversion of hydrocarbons.—Socony-Vacuum Oil Co., Inc. June 9, 1945. 12661-2-3-4/46.

Testing of metals.—Sulzer Freres Soc. Anon. June 7, 1945. 16846/46.

Reduction of iron oxide ores in rotary furnaces.—Titan Co., A/S. April 30, 1942. 34171/46.

Polymerisation of 2-vinyl thiazoles.—United States Rubber Co. June 5, 1945. 8091/46.

Creaming of synthetic rubber latices.—United States Rubber Co. June 6, 1945. 8092/46.

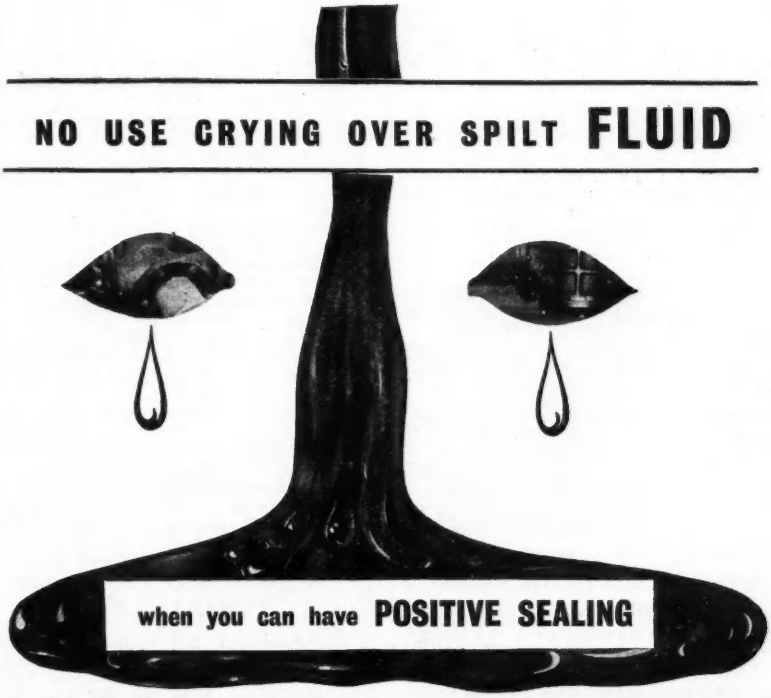
Mouldings.—V. Vltavsky. April 15, 1944. 33938/46.

Complete Specifications Accepted

Reduction of evaporation losses in the storage of liquids.—C. Arnold. (Standard Oil Development Co.) April 24, 1944. 582,990.

Process and apparatus for the polymerisation of olefins.—J. C. Arnold. (Standard Oil Development Co.) March 15, 1944. 583,047.

Thioplast-containing compositions suitable for use for sealing or adhesive purposes.—B. B. Chemical Co., Ltd., L. E. Puddefoot, W. H. Swire, and A. Bramley. Aug. 21, 1944. 583,007.



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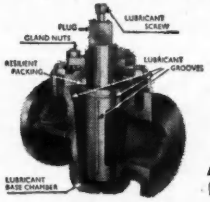

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Manufacture of nitronitriles.—G. D. Buckley, R. L. Heath, and I.C.I., Ltd. Oct. 9, 1944. 582,966.

Process for the filling of leather.—J. Burchill, D. J. Guest, E. Isaacs, L. B. Morgan, and I.C.I., Ltd. May 13, 1944. 583,096.

Silicon carbide articles and method of making the same.—Carborundum Co. Oct. 29, 1942. 583,039.

Electrodeposition of copper.—E.I. Du Pont de Nemours & Co., R. O. Hull, and A. G. Gray. Aug. 8, 1944. 583,003.

Processes for the production of cellulose pulp.—English Cellulose Derivatives, Ltd., and G. Ullmann. March 7, 1945. 583,074.

Surface-active compounds.—I.C.I., Ltd. (E.I. Du Pont de Nemours & Co.) March 8, 1943. 583,031.

Composite fabric and method for the manufacture thereof.—International Latex Processes, Ltd. July 3, 1943. 583,073.

Explosive salts and applications thereof. —D. T. Jones, L. Rubenstein, and I.C.I., Ltd. May 21, 1941. 582,976.

Manufacture of spectacle lenses from plastic materials such as polymerised methyl methacrylate or polystyrene.—A. W. Kingston, and J. Johnson. Dec. 31, 1943. 583,091.

Production of condensation products of the furylmethane derivative type.—P. C. Kruyff, and A. Van. Hoboken, jun., and J. H. Van. Hoboken (trading as A. Van. Hoboken & Co.) Nov. 11, 1939. 583,021.

Modification of the properties of filaments, bristles, yarns, fabrics, films and like shaped articles derived from nylon.—J. R. Lewis, and I.C.I., Ltd. Oct. 4, 1944. 583,014.

Method for the preparation of resin emulsions.—E. P. Newton. (Hercules Powder Co.) Dec. 9, 1943. 582,986.

Apparatus for producing spherical or other solids of revolution.—J. B. Nicholson, and Corrugated Packing & Sheet Metal Co., Ltd. April 27, 1944. 582,992.

Manufacture of dyestuffs.—Soc. of Chemical Industry in Basle. July 19, 1940. 582,977.

Manufacture of monoazo-dyestuffs.—Soc. of Chemical Industry in Basle. Dec. 22, 1942. 583,043.

Process for the production of sulphurised lubricating oils.—Standard Oil Development Co. June 6, 1942. 582,982.

Process for the production of olefinic polymers.—Standard Oil Development Co. July 30, 1942. 582,983.

Process for the control of temperature in catalytic oxidations.—Standard Oil Development Co. June 13, 1942. 583,032.

Production of therapeutically valuable naphthyridines.—Therapeutic Research Corporation of Great Britain, Ltd., and V. A. Petrow. Sept. 21, 1944. 583,109.

Magnesia and products obtained therefrom.—R. J. Tugwood. (R. P. Heuer.) Sept. 19, 1944. 583,009.

Separation, recovery or refining of metals. —A. G. E. Robiette, and P. F. Hancock. Dec. 9, 1953. 582,506.

Catalytic isomerisation of paraffinic hydrocarbons.—Standard Oil Development Co. March 26, 1942. 582,495.

Catalytic dehydrogenation of hydrocarbons.—Standard Oil Development Co. Aug. 26, 1942. 582,498.

Lubricants.—Standard Oil Development Co. Dec. 22, 1942. 582,500.

Manufacture of diolefin copolymers.—Standard Oil Development Co. March 28, 1942. 582,571.

Process for the catalytic dehydrogenation of hydrocarbons.—Standard Oil Development Co. June 13, 1942. 582,624.

Adhesive compositions.—United States Rubber Co. Aug. 12, 1943. 582,614.

Treatment of paraffinic tar oils.—Yorkshire Tar Distillers, Ltd., and D. W. Milner Aug. 29, 1944. 582,681.

Sizing compositions.—I.C.I., Ltd. July 29, 1943. 582,641.

Production of polymeric organic compounds containing chlorine.—I.C.I., Ltd June 17, 1942. 582,663.

Fractionation of glyceride oils.—Lever Bros. & Unilever, Ltd. June 23, 1943. 582,557.

Modification of the properties of filaments, bristles, yarns, films and like shaped articles derived from nylon.—J. R. Lewis, and I.C.I. Ltd. May 15, 1944. 582,518.

Modification of the properties of filaments, bristles, yarns, fabrics, films and like shaped articles derived from nylon.—J. R. Lewis, and G. Loasby. Sept. 29, 1944. 582,522.

Modification of the properties of articles derived from nylon.—J. R. Lewis, D. McCreath, and I.C.I., Ltd. May 13, 1944. 582,517.

Modification of the properties of filaments, films and other shaped articles derived from nylon.—J. R. Lewis, D. McCreath, R. J. W. Reynolds, and I.C.I., Ltd. Aug. 15, 1944. 582,520.

An arrangement for separating materials, especially dust or the like from air or gases containing dust.—T. B. Loftheim. Nov. 29, 1938. 582,480.

Methods of effecting the evaporation of water or solvents from liquids in bulk.— J. A. Reavell. Feb. 16, 1944. 582,575

Process for the manufacture of paper pulp and other products from the fleshy parts of sisal and similar plants.—African Sisal & Produce Co., Ltd., and R. J. Browne. March 16, 1942. 582,707.

Alkamine esters of 1-cyclohexylpyrrole-3, 4-dicarboxylic acids.—American Cyanamid Co. July 31, 1943. 582,903.

Casting metals.—R. W. Bailey, P. P. Starling, H. H. Burton, A. B. Winder, Metropolitan-Vickers Electrical Co., Ltd., and English Steel Corporation, Ltd. April 24, 1940. 582,846.

Aluminium copper alloys and their heat-treatment.—T. F. Bradbury. Feb. 25, 1944. 582,728.

Hard facing alloy.—Callite Tungsten Corporation. Aug. 13, 1942. 582,718.

Production of coloured synthetic resin compositions.—J. W. Coates, J. W. C. Crawford, and I.C.I., Ltd. May 19, 1944. 582,899.

Production of coloured synthetic resin compositions.—J. W. Coates, J. W. C. Crawford, and I.C.I., Ltd. May 19, 1944. 582,900.

Vinylidene chloride compositions.—Distillers Co., Ltd., J. J. P. Staudinger, D. Faulkner, and G. T. Wright. Dec. 8, 1943. 582,721.

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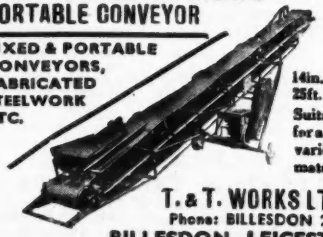
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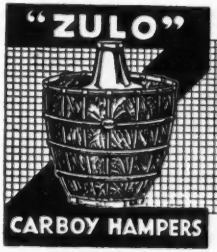
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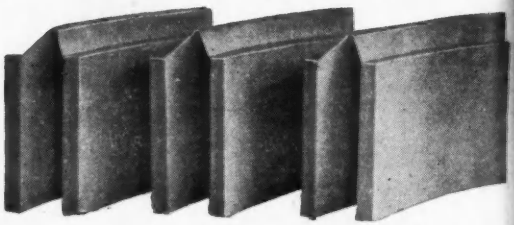

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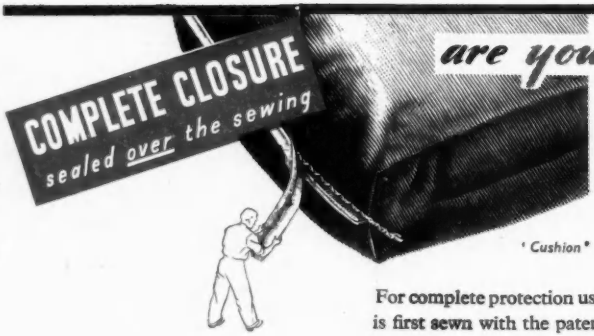

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